

9th Annual YEARBOOK

Number

# AVIATION

The Oldest American Aeronautical Magazine

McGraw-Hill Publishing Company, Inc. FEBRUARY, 1942 ONE DOLLAR PER COPY



## TWIN WASPS

### FOR THE ARMY'S LARGEST CARGO PLANES

Adapting the famed Douglas DC-4 for transport and cargo use, the U. S. Army Air Corps gains a mighty asset. With their great range and load-carrying ability, scores of these C-54's will play a vital role in speeding men and materials to strategic points. Each will be powered by four 1350 horsepower Twin Wasps.



**PRATT & WHITNEY AIRCRAFT**

EAST HARTFORD, CONNECTICUT

# An old timer SOUNDS OFF!

Hey, these kids flying today should see what we had to put up with back in '17. Every engine we were flying, we always had an eye on for an emergency landing, spot—never could trust an engine in those days—oil line was always breaking—engines quitting cold. Now, no one worries around about his engine.

"Get lost today and what do you do? Just push a button and they give you a nice boost up inside cabin. Us gals say, when we get lost, it was up to us to get back somehow. We couldn't even step over the side and had to—well, we didn't have chutes. These gals today have chutes and a 'Hot Wire' in case they fall into the drink.

"Remember those Catalinas? O.K., except at high altitudes—up there they just wouldn't answer. And the lights—a honey for power diving, but any day and you've said it all. Mustangs? Good, all-around ships, but as directed show you were fished before you started when you were up against a real speedy plane. Those DH's? Flying circles, we called 'em—and those rotary engine jobs—some of those would shake your back teeth out. Mind these kids today have planes that have got everything at all altitudes.

Right, you say, old timer? What you say is true, and you have had a magnificent job—but while it is true that American planes and engine builders have made tremendous progress in aviation since 1917, so have other countries. One day today, with the loss we can give them, would be up against planes that can take 300 miles per hour power dives, spend over 300 miles per hour, loop, barrel and zoom with the best of us today.

To depend upon better minded pilots is not enough. We must build planes that do have an edge on the other fellow's. American gains with the loyal help of American workmen can do it — at a doing it!

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Cleveland • Detroit • Los Angeles  
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machine and engine parts and material and  
engineered parts for the automotive industry  
a portion of the machine tools  
available today.

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Products



Illustration of Gipsy is one of the other examples of the Mustang line engine flight design described in page 114.

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McGraw-Hill Publishing Company, Inc.  
Editorial office: 1221 Ave. of the Americas, New York 10, N.Y.  
Telephone: MU 2-1212  
Subscription office: 1221 Ave. of the Americas, New York 10, N.Y.  
Telephone: MU 2-1212  
Advertising office: 1221 Ave. of the Americas, New York 10, N.Y.  
Telephone: MU 2-1212  
Business office: 1221 Ave. of the Americas, New York 10, N.Y.  
Telephone: MU 2-1212

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Published weekly, except for a year-end issue in December, at  
New York, N.Y., and at other principal cities.  
Second-class postage paid at New York, N.Y., and at other principal cities.  
Postmaster: Please send address changes to AVIATION, P.O. Box 114, New York, N.Y.  
Subscription price: \$3.00 per year in advance.  
Single copy price: 10 cents.  
Entered as Second-Class Matter, May 1, 1925.  
Acceptance for mailing at special rate of postage provided for in  
Section 1103, Act of October 3, 1917, authorized on July 1, 1942.  
Postage paid at New York, N.Y., and at other principal cities.  
Postage paid at New York, N.Y., and at other principal cities.  
Postage paid at New York, N.Y., and at other principal cities.

A MAGAWAY PUBLICATION

NINTH ANNUAL DIRECTORY NUMBER

# AVIATION

FEBRUARY, 1943

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As long as runways are made "just so long," and air field obstacles limit the angles of descent and take off, the Air Speed Indicator will deserve all the manufacturing and suspension precautions with which Pioneer Precision surrounds every Pioneer instrument.



**Pioneer INSTRUMENT**  
DIVISION OF BENDIS AVIATION CORPORATION • BENDIS, NEW JERSEY

**I**N ADDITION to the Yearbook is the new, AVIATION month's regular February edition. AVIATION's Washington editor again summarizes our's progress over the month in AVIATION's War Communique No. 2 (Page 78). He points out that Japan's ingenuity in the use of its easily obtainable, and describes what happens when her and American planes meet.

"From the Fight to the Factory" (page 18) emphasizes the importance of explaining to the average American worker why he is doing his job as well as how to do it. It demonstrates that when workers in factories and offices are shown how they fit into the big picture, and are convinced of the importance of their individual contributions to the total defense effort, they not only become better workers, but better citizens, too.

The significance of Annonia's unpolluted civil aviation plant to the present war effort is pointed up in a discussion of the organization and work of the Civil Air Patrol by war newsman editor. (Page 32)

Our civil plane production in 1941 spanned both old trends. Significant changes and new trends are discussed in AVIATION's annual roundup of the industry's civil production (page 54).

How the steady growth of civil aviation during the last years created the backbone of our aerial defense is graphically presented in a series of striking graphs and charts (page 56).

The manufacturing section focuses attention on ways and means of speeding filaments and increasing production. J. A. Harris, III, Chairman of the Board of Jacobs Aircraft Engine Co., tells how Jacobs increased and produced several thousand percent. (Page 98.)

A photo-caption article illustrates step-by-step the process of photo-etch plate making employed at the Lockhard plant. (Page 98.)

The development of plastics for structural applications in aircraft is getting forward. J. E. Johnson, chief of the Air Corps Materials Laboratory,

The Military's roll has ramped up significantly over some serious problems for

### YEARBOOK STATISTICS

Nearly 100 direct manufacturers, with addresses, names of personnel, distribution and dealers. Thirty engine manufacturers, with addresses, names of personnel

Approximately 1300 vehicle suppliers of parts, equipment, materials and services will be classified under the industry code.

## \* \* \* \* \* IN THIS ISSUE

THE BIG NEWS of this issue is AVIATION'S North Annual Directory, chock-full of industry facts, figures, personnel, plans, requests, equipment, materials. Edited for wartime requirements, it provides the largest classified array of timely and useful information ever assembled for this vitally important industry. (Page 135)

Already a larger task than ever before, our job was complicated by America's entry into the war. It suddenly became necessary to review all the material which we had been in the process of collecting and expending for many months just to determine whether any of it might constitute information of value to our enemies. In this connection, we were guided and assisted by the appropriate offices of the military establishments. We are sincerely grateful to these officers and officials who gave so unflinchingly of their time and energies to assist us in making a constructive contribution to a hard-pressed industry without, however, disclosing information which might aid or be of comfort to the enemy.

The result, we feel confident, is a study of immense value that through the months to come will be of immeasurable value to those men of responsibility in every phase of the industry who are struggling to meet or exceed the constantly accelerating output schedules imposed by the Victory Program.



GEORGE W. FTEL has been appointed publisher of AVIATION News Journal, Travel Journal News and Transportation, the transportation group of McGraw-Hill publications. The job is not new to him, however, for he has assumed full responsibility for the group since the death of Louis F. Stoll in January 1949. Mr. FTEL joined the McGraw-Hill transportation group in 1928. Prior to that he was connected with the Chase Journal Co. and the Chicago Publishing Co.

this expanding industry. Brig. Gen. Lewis B. Hawley, Director of Selective Service, explains the Government's policies and offers some timely suggestions. (Page 106.)

Executive Secretary Jack Fung of the Los Angeles Parts Manufacturers Association tells how this organization has learned subcontracting in Southern California. (Page 108)

Cityway views of the Bell Amphitheater, Hollaender Market, the turbo-prop charges and the Italian Caproni-Caproni propeller airplane are high lights of the sketch book. (Page 116)

**Coming** More up-to-the-minute production and engineering articles are in preparation for upcoming issues. Our editorial board puts its focus on the subjects of lighting, audio, broadcast and related to production speed and quality wherever we find them. New series like *in-depth* and *regular maintenance*, an article describing production methods employed in building one of the most important places in the war program and an *exclusive coverage* of the Tenth Annual Meeting of the Institute of the Aeronautical Sciences are coming up in March.

tion with more than 4,000 entries. . . . What we believe is the most complete collection of Overseas illustrations of mortal Americans, almost ever assembled. Nearly 100 illustrations of military and civil types. . . .

Thirty-six photographs and perspective railway drawings of outstanding street scenes. Hand 113 photographs of American streets with dimensions, percentages and other descriptive data.

Consistent specifications tables list handy reference material on data vs. dimensional performance comparisons and listed subjects on 112 American civil and military aircraft, 105 foreign aircraft, 144 American engines and 11 foreign engines. In addition, there are listed all U.S. operating airlines, with names of key personnel. **AVIATION'S** directory of schools and much other useful information is included.

THE ELEMENT OF "Chance" IS NO TRIFLE!



Calculated  
0.34  
Heavy Bomber

The element of "chance" is always with us! Even in this day of modern flying missiles—20-ton bombers and 600-mile-an-hour fighters—"chance", the unseen and relentless assassin, greedily waits for his opportunity to attack. He picks on the vital spots, the essential points of control and operation.

That's why you'll find Fafnir Aircraft Ball Bearings at vital points of motion on U. S. Army ships, U. S. Navy ships, and on commercial airliners. Modern aircraft designers and builders learned

long ago the lessons that "chance" could teach and were not slow to prevent recurrence.

Fafnir Aircraft Ball Bearings provide the important extra advantages of rigidity and tightness, without friction or binding; they reduce maintenance and adjustment. Their outstanding performance is attested by the fact that you and all other aircraft manufacturers have lowered "Fafnir" right on your sketches for more than ten years. The Fafnir Bearing Company, Aircraft Division, New Britain, Conn.

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Ball Bearings  
for  
Aircraft Engines and Controls



A 25 a piston engine and a number  
change of base



On the line. A 25 a piston  
change of base



From country airplane  
change of base

AMERICA'S FIRST-CHOICE AIRPLANE  
ANSWERS THE CALL TO THE COLOURS!

## The PIPER O-59

Now in Service with the U. S. Army

With their familiar yellow replaced by war colors, Piper planes were approved on service test order and are now being delivered in quantity to the U. S. Army Air Forces! They are serving the artillery, infantry, cavalry and armored units in observation, communication and liaison capacities. The same dependable characteristics which have made Piper Cubs America's favorite training plane ideally serve the purpose for which these ships are used by the Army. They can fly safely at low speeds. They easily land and take-off from small, restricted areas. Their simplicity of operation and rugged construction perfectly adapt them to the rugged, varied uses to which they are put and for which they prove their capabilities in the greatest percentage instances ever undertaken by the U. S. Army. See your Piper Dealer for a free flight demonstration in a Piper plane and ask him about the free flying course offered the purchaser of a new Piper.

**FREE CATALOG** showing all the Piper planes may be obtained from your Piper Dealer. Or, if you wish, we will gladly send you one of these handbooks, defining catalog which portrays all the new Piper ships in full technical detail, providing you with the in stamps or coin for postage handling. Piper Aircraft Corporation, Department A22, Lock Haven, Pennsylvania, U. S. A.







*American*

**T**his product of American Metal Hose Branch of The American Brass Company have been developed to their present high degree of efficiency over a long period of years in the laboratories and in the field.

Outstanding among these is a complete line of Flexible Low-Tension Shielding Conduit and Conduit Fittings made to AC, NAF, and AIN specifications.

American Flexible Aluminum Shielding Conduit is now being used on all scales of plants carrying radio equipment. Many plane manufacturers, to achieve their very busy electrical and assembling departments, use American's large assembling department—

staffed by experts and fully equipped for bending or soldering fittings direct to Flexible Shielding Conduit.

#### Other Valuable Products of American Metal Hose

American Metal Hose Branch is manufacturing pushbutton cord housing (in accordance with current Navy Department and U. S. Army Air Corps' drawings)—Flexible Fuel Mixture Induction Connections (conforming to Air Corps' drawings)—Hose for Vent—Flexible Exhaust Lines and Air Ducts for Carburetor pushbutton systems. These are only a few of the many American products now in wide use in the aircraft industry.



## Flexible Shielding Conduit for the Aviation Industry

#### Technical Service; New Aviation Book

The full line of products includes Flexible Metal Hose and Tubing made in practically every workable alloy and in a complete range of sizes up to 12" I. D. The Technical Division of the American Metal Hose Branch is always ready to cooperate in the development of special connectors for special purposes. One thing more: be sure to have in your file our new book "American Metal Hose Products for the Aviation Industry". It will be mailed without obligation, of course.



These mechanical Flexible Bending Machines will securely attach either straight or flared elbow fittings to Flexible Shielding Conduit. The bench type Flexible Bending Machine comes in two sizes, No. 1 for conduit up to 1 1/2" outside, and No. 2 for sizes 1 1/2" and larger. The No. 2 bench type Flexible Bending Tool is designed for use in maintenance and repair work.

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AVIATION - February, 1942

AVIATION - February, 1942



## To America at War...

Boeing and the other great aircraft manufacturers of this nation are prepared to meet today's emergency. Behind the airplanes now being used by the United States Army and Navy and behind the new aircraft daily issuing from this nation's production lines stand years of experience, research and tests... a background unequalled by any other nation.

At Boeing we are conscious that we are now faced with our greatest task in this firm's twenty-five years of progress. Our every thought, our every action is directed toward still further acceleration of the nation's war program. We are confident that whenever we have accomplished today we can accomplish still more tomorrow.

*T. G. Johnson*  
T. G. Johnson, President

**BOEING AIRPLANE COMPANY**

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*Unlimited Speed*  
IS THE ONLY ANSWER TO  
"PEARL HARBOR"



**WE  
ARE READY**

to meet the demand for Conduit  
Clamps either plain or with **SPEED  
NUTS** attached.

*The Fastest Thing in Fastenings*

**S**PEED is the essence today. And **SPEED NUTS** are unequalled in assembly speed. As illustrated, our new A-C-755 type tube clamp, with self-retaining **SPEED NUT** attached, requires only the use of a screw driver to assemble. It securely grips the screw with a double spring tension lock to prevent vibration loosening. The assembly is simplified, time is saved and weight reduced. For complete information on sizes and types, write for bulletin No. 148-E.

This is only one of hundreds of **SPEED NUTS** and **SPEED CLIPS** that are cutting aircraft assembly time to a new low.

Let the speed of the **SPEED NUT SYSTEM** help roll these planes out faster every month, and lower your net costs whenever speed nuts are used. Send us your assembly details and we will mail you samples and engineering data promptly.

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MANUFACTURERS OF PATENTED SPEED NUTS

IN ENGLAND: Edwards Accessories Ltd., London

Accelerates Assembly

*Speed Nut System*

Lowers Net Costs



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Only an instant of diverted attention due to seating discomfort may mean the difference between success and failure for the pilot. • Seating must be adapted to the specialized duties of men who guide our defenders in the air. These men must be always alert, ready to turn, to swing up or down, or to attack... instantly. • Pilots must be comfortable, with every reserve of energy responsive to the quickly changing scene. • Designs for Airplane Seating represent the skillful study of experts. • Translating these designs by the seating craftsmen at GF represents all that can be desired in performance, in light weight and in dependable long life.

THE GENERAL FIREPROOFING COMPANY

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To keep new members from  
the *Caterpillar Club*...



"TRIGGER" STEEL from the Roebling Open Hearth is the most uniform of steel used this is fixed for your job. Made by Roebling, of our materials selected by Roebling, or copy of this "selected" steel is the right beginning for every second wire product Roebling makes.

... No wonder  
**ROEBLING**

leads in AIRCRAFT WIRES and FITTINGS

AVIATION, February 1940

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**JOHN A. ROEBLING'S SONS COMPANY**

BOSTON, NEW JERSEY

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# CHICAGO AND SOUTHERN



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Douglas Aircraft Co., Inc., Santa Monica



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**100% Douglas EQUIPPED**

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the British Royal Air Force—and to lead-  
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- Sheet Metal Stampings and Welded Assemblies
- Aircraft Lighting Equipment



STANDARD AIRCRAFT PRODUCTS, INC.  
DAYTON, OHIO

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—the Super-Bulldozer Company  
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Remington

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After being helped by one of the relatives  
of the 1000 series, we have decided to order the  
1000 series.

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of the 1000 series is very important. We will  
order the 1000 series because it will give us the  
best value for our money. We will order the 1000  
series because it will give us the best value for  
our money. We will order the 1000 series because  
it will give us the best value for our money.

Yours very truly,  
BENDER INDUSTRIES, INC.

BAKER INDUSTRIAL TRUCK DIVISION

2141 WEST 10TH STREET • CLEVELAND, OHIO



One of the many Provident Classes conducted by Bendix Radio and attended voluntarily by Bendix Employees who wish to have special skills or to perfect themselves in their present job—to learn more, in order to work more.



Small groups of Bendix Employees are given specialized instruction in special skills.

## No Dictator said, "You Must Attend This Class!"

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... Is the truly American way, by helping employees and cooperative employees learn more and more more. Bendix has built a reserve of skilled and specially trained technicians which made possible the organization's tremendous expansion to meet today's needs. Made it possible, too, without sacrificing the high

Bendix tradition of sound engineering, precision construction and superior performance which characterizes Bendix Radio Equipment.

... Today Bendix Employees are answering the challenge of defense-driven industry in the American way, with a cooperative "all-out" effort to supply more, and still more, vital equipment for our fighting forces. Bendix Radio, Division of Bendix Aviation Corporation, BALTIMORE, Md., U.S.A. Cable Address: BENDIX.





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Equipment Pays for Itself on First Contract.

Figure this out for yourself. The Cost of Thermonic Heat is 1/10th of a Center per broze (based on 2¢ per KWH). Compare this with other methods of heating which average from 3/4 to 2¢ per broze. On a million component contract you save approximately \$7,500.

Push Button Control. Continuous Flow of Production — 10,000 Units per Day.

Controlled Temperature — Heat Confined to Desired Area.

Components Have Passed All Official Physical Requirements.

No Rejects. Every Unit is Heated Uniformly.

Skilled Labor Not Necessary.

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*A*S BOLD as the wildest ally which it has been named, the formidable Grumman F4F-3 U.S. NAVY FIGHTER boasts an enviable record in the day-in, day-out performance of its grueling task.



**2 TO 5 TIMES  
MORE PRODUCTION  
PER MAN PER MACHINE**



**Courage to try a new Grinding Wheel may  
solve your labor and machine shortage now**

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Properly used it takes double cuts, knocking through 600° or more. It grinds 100 to 400% faster, increasing production per man per machine 2 to 5 times. But that's not all. Por-os-way also a little sweeter, to load or heat the work. Here is the reason. Por-os-way is made by a new patented process. The structure instead of being "sandy" and con-

part is "stringy" and porous—something like a sponge. Millions of air cells allow the air to keep every grinding contact cool. Yet Por-os-way is hard, tough, holds the surface and requires very little dressing—due to a new vitrified bond.

The unique grinds hard alloys, with cast, copper, aluminum, wood, rubber, plastics and other soft materials with maximum loading. Run this wheel. Try it and learn how much faster and cooler it grinds. Write today for a trial demonstration on your machines. A. E. Stevens & Son Inc., PHOENIXVILLE, PA.

**POR-OS-WAY** is **RADIAC** PRODUCT

ASK FOR A  
DEMONSTRATION

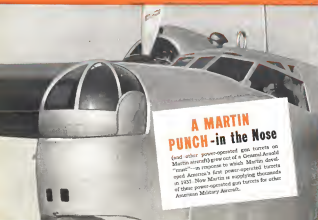




# Now MARTIN Developments used throughout Industry pay War Dividends

**M**ADE available to all industry, many Martin developments now are speeding America's war output, improving America's military materiel. A few of these developments are pictured here. Some are still cloaked in secrecy. Hundreds of others, undeniably minor but collectively important, are making a major contribution to America's war effort. Meanwhile, throughout the Martin organization, more developments are afoot—to add new might to tomorrow's aircraft, new efficiency to tomorrow's production methods.

THE GLENN L. MARTIN COMPANY, BALTIMORE, MD., U. S. A.



## A MARTIN PUNCH-in the Nose

(and other power-operated gun turrets on Martin aircraft) grew out of a General Arnold "turret"—an innovation to which Martin developed America's first power-operated turret in 1931. Now Martin is supplying thousands of these power-operated gun turrets for other American Military Aircraft.



**A 1940 General Arnold "Must"**—self-sealing fuel tanks. Martin—with the Mering self-sealing tank—was first to answer. Welded by machine gun fire, the Mering tank remains leak proof—in new standard equipment on many American Military Aircraft.



**Robot Draughtsman** were Martin's solutions when expansion made a shortage of engineers inevitable. Now Martin's giant photo layout method reproduces drawings in full scale devoted to sheet metal, eliminates layout time, makes available hundreds of engineers for more important work.



**Iron Fingers Sort Rivets** in sorting the thousands of rivets swept from Martin floors each day. This rivet sorter is just one of scores of minor labor-saving devices developed by Martin to save precious man-hours that will help reduce the duration of war.



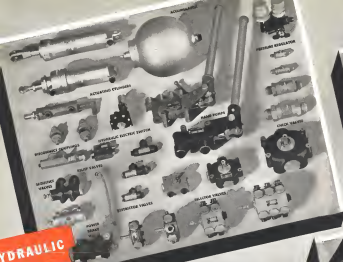
**Plastic Pioneering Paid Off**—when aluminum became critically scarce in 1940. Winner of the 1940-41 Modern Plastics Award, Martin now uses plastics in place of aluminum for 900 different aircraft parts. Featured is the business end of a Martin B-26—made of tough, light-weight plastic.

# Martin AIRCRAFT

Backers of Dependable



Aircraft Since 1908



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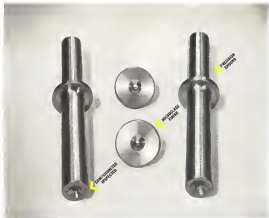
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At Singapore

BY DONALD W. HILL

WASHINGTON, Dec. 19—(AP)—The first American fighter to be shot down by a Japanese plane was a Buffalo.

The Buffalo was shot down by a Japanese plane over Singapore.

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Bethlehem Products Company, Glenside, Pennsylvania Division of Bethlehem Steel Export Company, New York

IN FLIGHT AND  
ON THE GROUND

**TWA**  
The  
**TRANSCONTINENTAL**  
Airline

Serves its famed "Stratoliners" with

**Snap-on**  
**Tools**



The nation's largest air transport. A Transcon TWA Stratoliner.

"TWA's primary expense is mechanics. To use tools designed and constructed to standards of excellence comparable to the flying equipment they service" . . . says Mr. Minfield, TWA Superintendent of Maintenance. "Our Flight Engineers who are selected from the ranks of skilled service mechanics are required to carry a small kit of tools."



**OVER 3000  
HAND AND POWER  
TOOLS—FIRM  
HOTSET MEASURES  
TO MEET ONLY  
ONE  
UNIT**



**SNAP-ON TOOLS CORPORATION, 8020E 25th Ave., Kenosha, Wisconsin**

A Stratoliner Flight Engineer checks his tool kit just before departure, while the five other tools on



so perform minor adjustments on Stratoliners while in flight. A recent survey indicated that Snap-on Tools were well represented in the kit of our engineers."

These studies leader in the field of aircraft maintenance studies on the utility and high quality of Snap-on tools . . . dependable aids to fix, fast workmanship in aviation as well as in commercial and industrial fields where Snap-on design and performance have been and standards for the past twenty-two years.

The 3,000 tools in the Snap-on line . . . and Snap-on's deep-to-you service . . . are conveniently near you from 35 factory branches at key locations throughout America. Steel for cutting and full information.





Some like this Warner aircraft engine in the Allison Shop. The Air Corps is getting an Allison engine from the Allison shop. Coming from the Air Corps.

## "MISSION COMPLETED —AWAITING ORDERS"\*



We tell you this story of Allison simply because we think you ought to know what is actually taking place in various production in America in the busy, mid-day places where the work is done. It moves what you see all over the country behind the scenes. There is a lot of you will find, engine for all freedom-loving people in the hands and courage, for when we are all, when our and America are strong.

We had a conflict, a pair or "can do" — and an abundance of "can do" American spirit.

We had an engine house was "ups," some when an idea to make a better, and the customer attention to put it in mass production.

But no one had ever built in shared early line an engine except piece by piece, one at a time, by hand.

No one had ever seen the kind of factory we needed — windowless, air conditioned, "blended out" completely — where extremely precise work could go on unobstructed night and day.

No one had the super-standard, super accurate machine tools called for, and there were only a couple of hundred trained men, when one day we would need thousands.

One thing more we had — a job that had to be done: The Air Corps wanted Allison. Lots of them. Fast!

To make a breezy story short — the Air Corps is getting its Allison.

\*Many times indicated, October 1941, 1942

Getting done in the quantities called. Getting them by the time it.

Where the engine had stood, 1,000,000 square feet of modern factory space in full production, busy night and day.

When the engine had stood, 1,000,000 square feet of modern factory space in full production, busy night and day.

From a hundred subcontractors scattered over the country come parts and subassemblies, in a smooth flowing stream of supply that had to be set up from scratch.

From our two skills are streaming out Allison for better than the original pattern — in a good many times the one look at engine delivering 215 new horsepower each then was usually repeated, achieved without change in engine size and with reduced weight per horsepower!

All of this meant we have made good on our promise — have met our responsibility.

All of this meant we have made good on our promise — have met our responsibility.

All of this meant we have made good on our promise — have met our responsibility.

All of this meant we have made good on our promise — have met our responsibility.

Our last mission is completed. This engine is rolling at peak capacity on schedule — already thousands of Allison engines are giving a magnificent account of themselves across the world.

We are proud of this, of course, for ourselves and especially for American industry of which we are a part.

For you can count on it, America! — what Allison has done and is doing in being expected in factory after factory in this unwarlike land and will be repeated everywhere in months to come.

The talk ahead of us all in this nation is vast and great — but it will be gloriously done.

Big as it is at any time, the job is in hand — devoted, daring, generous effort in taking on business — all we need now is more of the same!

The following planes are all powered with the Allison liquid cooled engine:

- Grumman F6F Hellcat
- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair

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- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair
- Grumman F6F Hellcat
- Grumman F4U Corsair



DIVISION OF



### PESCO offers you two important advantages:

1. A complete line of Fuel Pumps, Vacuum Pumps, Hydraulic Pumps, Valves and Accessories proven by millions of flight miles.
2. A seasoned staff—in management, design, production and field service—directed by top-ranking executives with years of experience in aircraft design.



**PUMP ENGINEERING SERVICE CORPORATION**  
DIVISION BORG-WARNER CORPORATION • 12910 TAFT AVENUE • CLEVELAND, OHIO

# GHOST PROOF



## This new tracing cloth defies moisture stains and erasure scars

This new tracing cloth won't show preparation stains or trace marks—both pencil smudges and eraser marks at a moment's notice. Now you can have clean tracings, in pencil or ink, free from those unsightly "ghosts" that reproduce on blottings!

For PHOENIX is ghost-proofed by a remarkable new process that defies moisture and gives you an unusually durable working surface. You can use harder pencils with this improved cloth and get sharper lines with less tendency to smudge. Even 6H lines down clearly, and reproduce strongly! Erasing does not mar the drawing surface, smudged areas wipe pencil smoothly—and ink without fouling. Its new white color and accurate transparency give you excellent drawing contrast and produce strong blottings.

Put PHOENIX through your own drawing board test. See your K&E dealer, or write for a generous working sample and an illustrated brochure.

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**K&E**  
**Phoenix**  
TRAACING CLOTH  
for pencil and ink



**PHOENIX RESISTS  
MOISTURE STAINS**

Pencil marks and eraser marks on ordinary tracing cloth soon "ghost" when reproduced on blottings! PHOENIX Tracing Cloth, which resists all liquid moisture, is ghost-proofed and erases without leaving a trace!



**PHOENIX RESISTS  
ERASING SCARS**

The new improved surface of PHOENIX Tracing Cloth permits you to use harder pencils (H and 6H) and to get sharper lines with less tendency to smudge. Erasing does not mar the drawing surface, smudged areas wipe pencil smoothly—and ink without fouling.



**PHOENIX RESISTS  
ERASING SCARS**

Ordinary tracing cloth becomes spotted when moisture smudges upon it. PHOENIX Tracing Cloth, which resists all liquid moisture, is ghost-proofed and erases without leaving a trace!

## EMERSON ELECTRIC

51 YEARS  
OF ELECTRIC  
MOTOR DESIGN

### Immediate Advantages Offered to Aircraft Engineers Interested in Electric Motor Applications



#### DESIGN

Long years of patent research—hundreds of tests with specially designed scientific apparatus—percentage manufacturing—only play a vital part in the designing of motors for specific requirements. Consequently, Emerson Electric is today in the Aircraft War Program through the production of Emerson Motors. The largest plant ever built, exclusively for Power Turbines, is now being placed in operation.

#### FACILITIES FOR QUALITY PRODUCTION

Guaranteed for emergency production—Emerson Electric is flexible enough to meet the quick change demands of military aviation. . . . You are invited to consult Emerson Electric—for ENGINEERING SERVICE—for PRECISION-BUILT MOTORS.

THE EMERSON ELECTRIC MANUFACTURING CO.,  
ST. LOUIS • GREENBUSH, NEW YORK • CHICAGO • CHICAGO

**EMERSON**  **ELECTRIC**

S. H. P. and Smaller **ELECTRIC MOTORS FOR AIRCRAFT** S. H. P. and Smaller



# CUNO Girdles the Globe—with PAN-AMERICAN

*The 21,879 Mile Flight  
Odyssey of the Pacific  
Clipper High-Lights  
the Value of  
"The Filter that  
Cleans Itself in Flight"*



Reprinted by Pacific Clipper air line, and reproduced with permission of The New York Times

A PURELY routine operation," said Captain Robert Peard—but the facts of his recent round-the-world flight are in themselves a tribute to Pan-American equipment and the ability of both Captain and crew to maintain efficiency under difficult conditions. Details of the route are confidential, but the map above, reprinted from the New York Times, indicates the Clipper's probable course.

## In Mid-Pacific When Japs Struck Pearl Harbor... Varying Fuel and Oil Put Filters to Severe Test

Skirting the war zones as it touched on five continents, the giant 42½ ton craft completed the

trip in 209½ flying hours. The varying quality of gas and oil obtained along the route increased wear and tear on engine parts, but its four Twin Row 1,588 h.p. Wright Cyclones were protected against dangerous foreign particles in lubricating oil by the continuously cleanable Cuno filters.

## Majority of Aircraft and Engine Manufacturers Use Cuno Filters Today

It was this continuously cleanable feature, pioneered by Cuno, which first led to the widespread adoption of Cuno Auto-Klean Filters for aircraft engines... to overcome the danger of clogged filters on long flights... to reduce maintenance costs and time... and to safeguard

every last detail of high speed, extended operations.

Of non-collapseable all-metal construction, the Cuno Auto-Klean operates by edge filtration, and does not require periodic replacement. A single, built-in oil motor, operated by the filtered lubricating oil itself, makes cleaning continuous and automatic. Stationary cleaner blades, extending into each slot of the rotating element, comb out embedded solids.

Recently, other feed-handling problems—glycol heating systems... hydraulic control systems... have been solved for the aircraft industry by Cuno engineers. And, at the same time, Cuno's field service follows through from installation into actual operation.

Cuno engineers are ready to consult with you on any filtration problem, or to assist you in familiarizing your maintenance men with filters by Cuno—the Company that safeguards the fluids that safeguard flight.

KEEP FLOW ON "GO" WITH  
**CUNO**  
THE "FILTER-FINE" STRAINER

## Keeping Fluids on "GO" Around the World



The mechanic is building the band and cartridge assembly of a Cuno Auto-Klean when filters glow and a leading spokesman is the Pacific Clipper. On the table is one of the door self-cleaning cups of filters built as an standard equipment on Wright Cyclones. Note the cleaner blades. Reaching into each slot of the rotating element, these thoroughly secure embedded solids from the flow area, preventing sludge accumulation inside the filter element. Hence, there's no danger of filter collapsing, and stream service is reduced to a minimum.

Cuno Engineering Corporation, 702 South Vine St., Meriden, Conn.





# SCHATZ

*Precision*  
**AIRCRAFT  
BALL BEARINGS**

SCHATZ CONTROL BEARINGS  
MEET THE MOST EXACTING  
ENGINEERING SPECIFICATIONS •

PROVIDE

SAFE DEFENDABLE CONTROL •  
STRONG • TOUGH • ACCURATE  
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SCHATZ REPUTATION FOR PRECISION  
MANUFACTURE KNOWN AND RECOG-  
NIZED WHEREVER BALL BEARINGS  
ARE USED •



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POUGHKEEPS, N. Y.

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Strictly defense, production line open for government approved items, with samples immediately available for any job for the U. S. Army, Army Air Corps, Navy, Naval Air Corps, Marine Corps, Signal Corps, Ordnance.

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LARGEST LINE OF RELAYS SERVING AMERICAN INDUSTRY

SAMPLES OF APPROVED CONTROLS  
AVAILABLE ON SHORT NOTICE

GUN TARGET HANDLES  
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TARGET CONTROLS  
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NAVIGATION CONTROLS  
AIRCRAFT CONTROLS  
BOAT RELEASES



# Tannewitz

## "BIG BERTHA" DI-SAWS

**30 TO 48 INCH  
THROAT CAPACITY**

Extend the tremendous economies of Die Sawing, Filing and Polishing to the largest type of work

Made with 28", 36", 48" and even larger throat capacities if desired, these machines are identical in general construction with our Model M-34 with 36" throat capacity, the machine which has been named the most highly developed die saw on the market. And like the M-34 they will show an average saving of 70% of the time required by other methods in molding inside and outside cuts on dies, tools, jigs, templates, fixtures and dozens of similar operations. Whatever your requirements may be, write DOW for the Tannewitz Die-Saw Bulletin. You'll find it contains the machine that's ideally suited to your needs.

**THE TANNIEWITZ WORKS, GRAND RAPIDS, MICH.**

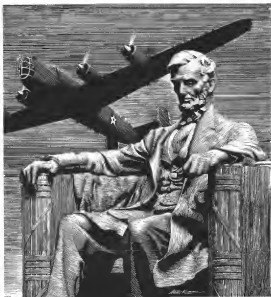
**DOWTY**

CONTRACTORS TO THE UNITED STATES ARMY AIR CORPS, R.A.E., R.C.A.E. & R.A.F.

**EQUIPMENT CITY, NEW YORK**

**LONG ISLAND CITY, NEW YORK**

HYDRAULIC & PNEUMATIC EQUIPMENT FOR AIRCRAFT



The Liberator

"Let us have faith that right makes might; and in that faith let us to the end, dare to do our duty as we understand it."

*Abraham Lincoln*

**Consolidated Aircraft Corporation**  
SAN DIEGO • FT. WORTH

AVIATION, February, 1942



## SPEED UP PRODUCTION BY PREVENTING CORROSION "THE PROTEK-SORB WAY"

Since December 8th, 1941, prevention of corrosion has taken on greater significance—it must be eliminated completely! Planes, tanks, guns and vital supplies must flow from the production lines in an unbroken stream—time-wasting methods cannot be tolerated!

Protek-Sorb, the protective absorbent, saves valuable time because it eliminates the hazard of corrosion—WITHOUT THE USE OF TIME-WASTING SLUSHING COMPOUNDS. Shipments of vital parts and supplies are delivered in perfect condition—clean and ready for

latest use. It's the modern answer to the Victory Campaign's call for... SPEED!

Protek-Sorb's method of corrosion protection is fundamental—it prevents corrosion by removing the cause—oxygen water—the shipping container. Any product can be protected by Protek-Sorb. Engine parts, accessories, complete engines and even complete planes and tanks are right now being given Protek-Sorb protection during storage and shipment. For speed plus positive protection—protect your product with Protek-Sorb.

PROTEK-SORB MEETS U. S. GOVERNMENT SPECIFICATIONS TO THE AIRCRAFT INDUSTRY

### HOW TO USE PROTEK-SORB

Protek-Sorb is not a protective coating. It is a chemically inert, granular material that absorbs more than 42% of its weight in moisture. Mixed within the shipping container with the product, it reduces the relative humidity far below the danger point. Its moisture damage-corrosion rate reduces, instead of delayed action—can occur in its presence.

Applied in small, convenient, ready-to-use dust bags packed in cartons shipping containers. Write for detailed literature.

**Protek-Sorb**  
IS A DAVISON PRODUCT

THE DAVISON CHEMICAL CORPORATION  
UNIONVILLE, MICHIGAN • BALTIMORE, MD.

AVIATION, February, 1942

# Who trains the bomber pilots?

*In Canada . . .*



*In the United States . . .*



**T**HE Cessna Aircraft Company has delivered more twin-engine bomber-pilot trainers than all other U. S. aircraft manufacturers combined. For 1962 we pledge ourselves to continue and surpass our past record of consistently exceeding delivery schedules . . . to do our full part in the all-out fight for Democracy.

## CESSNA



*Aircraft Company*

WICHITA, KANSAS, U. S. A.



CONTRACTORS TO THE U. S. ARMY AND THE ROYAL CANADIAN AIR FORCE



# Powered by Lycoming

The nation's pilots have for years trained behind Lycoming engines. The grind of student instruction provides testing of dependability as rigorous as combat flying. Now, for multi-engine familiarization and instrument training, Lycomings power the Cessna AT-8 Advanced Trainer.

For literature or request for 30 or 120 h.p. best-in-class approved or 150 or 160 h.p. radial engine. Write Dept. A-10, Specify which literature desired.

Contractors to the U. S. Army and Navy



LYCOMING DIVISION, THE AVIATION CORPORATION

THE TRAINING PLANE  
ENGINE OF TODAY  
THE PRIVATE PLANE  
ENGINE OF TOMORROW

WILMINGTON, PA.

There is *no shortage* of Torrington Needle Bearings for price by applications. They can be delivered with the promptness you need to maintain your production wheeling!

When the Needle Bearing was introduced eight years ago, design engineers in every field quickly recognized its unusual merits. Encouraged by the steadily rising rates the combined industry's growing acceptance of the Needle Bearing, Torrington began a program of plant expansion designed to permit wider utilization of the bearing's possibilities.

With the beginning of defense services, industries of war became demands provided the basis for further expansion, and today production is geared to meet the needs of the heavy program.

The Needle Bearing has already demonstrated its efficiency in countless industrial applications, where it

**NO  
SHORTAGE  
HERE!**

#### THE TORRINGTON COMPANY

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London	Los Angeles	London	London



## TORRINGTON NEEDLE BEARING

#### EFFICIENT OPERATION



Torrington Needle Bearings permit efficient operation in a wide range of applications. They are used in all types of machinery, from the smallest to the largest, and in all types of service, from the most severe to the most exacting.

THE A. C. S. MOTOR COMPANY

#### SAVINGS IN WEIGHT

Needle Bearings themselves are light in weight, and their simple design offers extreme lightweight weight savings through simplification of manufacturing parts. Their advantage is especially apparent in aircraft applications—for example, in Republic's P-41 Sabre fighter plane.



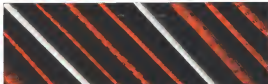
REPUBLIC AVIATION

#### LONGER SERVICE LIFE



Due to Needle Bearings' six inch diameter, the greater material strength of Torrington & Brown's No. 2 Torrington Needle Bearing in larger size of the same, makes them especially well suited for use in the most severe conditions. The Needle Bearing's six inch diameter is the standard in the industry.

THE WEBER & WISNET CO.



## AUTO-LITE·Sterling

*Presents*

**A New and Approved Aircraft Wire  
—Synthetic-Insulated!**

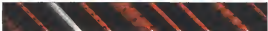
As a means of conserving rubber, Auto-Lite Sterling is now producing a new, synthetically-insulated aircraft primary wire which meets all operating requirements, and is already in use on current American aircraft production.

More than two years ago, when it first appeared that our rubber supply might be jeopardized by war, Auto-Lite Sterling engineers initiated research activities for an alternative insulating material. With equal foresight, they looked not only to its laboratory development, but also to methods of volume production to meet aircraft standards. When the plan came, Auto-Lite Sterling was ready!

As a means of conserving rubber, Auto-Lite Sterling is now producing a new, synthetically-insulated aircraft primary wire which meets all operating requirements, and is already in use on current American aircraft production.

This new cable takes its place in the complete line of aircraft ignition, primary, and starting cables built by Auto-Lite Sterling to the Army-Navy Joint specifications. These aircraft wires and cables are available both for original installation and for maintenance service. Keep 'em Flying!

**The Electric AUTO-LITE CO., Port Huron, Michigan  
WIRE DIVISION**



# NORMA-HOFFMANN

## PRECISION BEARINGS



*for*

### AIRCRAFT CONTROLS

Identified with the aircraft industry from its earliest days, NORMA-HOFFMANN pioneered many of the important bearing types now accepted as standard in aviation practice. " " " " Today, almost every representative builder of aircraft, engines, instruments, and equipment—including the United States Government—employs NORMA-HOFFMANN PRECISION BEARINGS to insure safety and long, uninterrupted service. " " " " Typical NORMA-HOFFMANN Aircraft Bearings are here illustrated. Write for the general Engineering Catalog which describes 108 distinct sizes embracing over 3000 sizes—a PRECISION BEARING for every load, speed and duty.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN. U.S.A.

PRECISION BALL, ROLLER AND THRUST BEARINGS

## First Step to Victory...

Somewhere in America today at the very moment you read this a student pilot is taking off on his first solo flight. Every hour... every day thousands more are climbing into the sky with America's answer—the greatest air force the world has ever seen.

Kinner fully realizes its obligation in building many of the engines for primary training with which America takes its first step to Victory.



KINNER MOTORS, INC., GLENDALE, CALIFORNIA



PM KINNER ARE the mighty men of the thousands of Kinner Engines in service throughout the Americas, saying "Buckle up!" to speed the Allied Fleet on their Victory mission.

# What you can do to help busy hands work *faster!*



**MILLER**  
50 FOOT CANDLER  
100 FOOT CANDLER  
MILLER TROOPERS  
Continuous Wireway Fluorescent  
Lighting Systems

A MILLER Continuous Wireway Fluorescent Lighting System in your plant will minimize worker eye fatigue . . . increase production efficiency . . . speed up output.

Here's a proven way to help your men work better, faster, more safely and with less eye fatigue. Install MILLER 50 foot candler or 100 foot candler in your factory crane and MILLER TROOPERS in offices and drafting rooms.

Help them see what they're doing clearly and cheaply, with 50 foot candler or better working light.

Then it's "working time!" we're talking about. At a cost of a few pennies per man-hour it will ensure dollar savings in production for you. It is doing that today for other leading office plants.

Prompt response from you will enable us to speed deliveries, render you superior service. Ask today. (Representatives on principal cities.)

To see you get these  
**5 MILLER Advanced Lighting Units**

**MINIMUM EXPLANATION** . . . 50 or 100 foot candler with wireless light distribution

to 50 sq. ft. **QUICK INSTALLATION** . . . 1. No wire, no conduit, no ducts, no ducts

**QUICK INSTALLATION** . . . 2. Easy to handle, no special tools, no special installation

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• MILLER offers a complete line of fluorescent and incandescent lighting equipment



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**... Demands  
Far Better  
Performance  
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1000 h.p. . . . 1500 h.p. . . . 2000 h.p.—and up! Aviation engineers have done a magnificent job of giving man push to Aviation's air power.

But every step-up in engine power—every increase in compression—has complicated the problem of lubrication. To solve this problem, Wolf's Head has pioneered refinishing improvements that have kept pace with each progressive change in aviation engineering. Result: the best in aviation of today is actually better than the best available two years ago.

And the best evidence of Wolf's Head achievements is this: Pan American Airways (the world's largest international air transport system) has used Wolf's Head for

• OVER 13 YEARS

• OVER 900 MILLION PASSENGER-MILES



**WOLF'S HEAD**

*Aviation* MOTOR OIL

Wolf's Head Oil Refining Co., Oil City, Pa.—New York, N.Y.

## THE BUSINESS END OF EFFICIENT OPERATIONS

More hours in the air, fewer hours for extra training, start up the operations story whenever Ranger-powered aircraft are flown, whether it's in the Army Air Corps, the Navy, the Coast Guard, the CPTP, or the CAA.

One basic factor contributing to this greater efficiency is the remarkable smoothness of the Ranger-in-line engine. This smoothness, a cross-planted principally by inherent design, cuts down maintenance. It means almost a complete elimination of valve checks, a pronounced reduction of oil leaks, a minimization of attention required for surplus structure and cooling, and a prolongation of the life of the engine.

Today, when every extra hour, every extra minute in the air means so much, Ranger can be counted upon to play its part.



With Ranger there can be no compromise with quality.



# RANGER

## AIRCRAFT ENGINES

FARMINGDALE, LONG ISLAND, NEW YORK  
DIV. OF FAIRCHILD ENGINE & AIRPLANE CORP.

## The instructor looks at WAR-TIME training

To the instructor, training in war-time means more hours in the air. So he seeks with satisfaction the full confidence-inspiring design of the Fairchild Trainer. This plane will give his students the feel of modern tactical planes from the start.

He studies the extremely rugged landing gear, approving its straight up-and-down travel and the generally wide track. That means excellent landing characteristics with stresses enough for the toughest landing. No ground loops or damaged wing tips here.

Finally, after thoroughly investigating the manually operated, three-position flap—the roomy cockpit—the unique Fairchild wing with its high degree of lateral control in stalls—the accessible tail-wheel—the unobstructed vision from both cockpits—his decision is unmistakable. ...The Fairchild Trainer is designed to meet in every way the exacting requirements of operations under war-time pressure, to prevent the delays of sick dents, to lower the costs of maintenance.

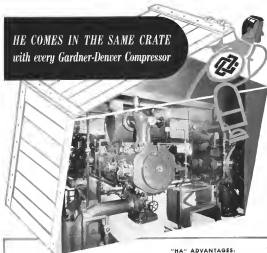
## FAIRCHILD AIRCRAFT

DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION  
HARTFORD, CONNECTICUT GALE BRIDGE "FARMINGDALE"





HE COMES IN THE SAME CRATE  
with every Gardner-Denver Compressor



#### "HA" ADVANTAGES:

- 1 Heavy, cylinder, piston and other vital parts of G-Duty for added strength and hardness.
- 2 Streamlined air passages and large valve areas ensure high overall efficiency.
- 3 Larger water-cooled areas assure a cooler compressor.
- 4 Tension-type bearings provide an unchanging air gap for the life of the machine.
- 5 Capacities from 465 to 1854 cubic feet displacement per minute.

**G-Duty!** G-Duty is a mighty handy fellow to have around your plant three days. For he represents the extra performance, the extra efficiency—the extra low-cost operation of Gardner-Denver "HA" Two-Stage Horizontal Compressors.

The maximum air output of these compressors is the result of better design, advanced engineering methods and the extensive use of G-Duty—the modern, high strength cast iron developed by Gardner-Denver engineers.

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**TYPICAL USER REPORT:** Our "HA" has operated 24 hours per day, 7 days per week for the past eight years, and has required only routine attention. Rotor seals bearings have never been touched at any time.

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LOCKHEED AIRCRAFT CORPORATION • BUNBAY, CALIFORNIA

# One more reason why the **AXIS** CAN'T WIN

## HALL

**HALL 1000, 1000 Type**  
Grinder. Grinds all  
engine valves and  
other engine parts  
and grinds all  
other engine parts  
to match. Grinds  
all engine valves  
to match.

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# TO THE preponderance of American airplane production and the superiority of these planes add the fact that HALL ECCENTRIC grinding is the accepted method in both our valve seat production and maintenance at home and abroad and you have one more important reason why the Axis can't win. Only America and its Allies have access to HALL ECCENTRIC Valve Seat Grinding only they are assured of valve performance that no Axis plane can duplicate. If you have a valve seat grinding problem, put it up to HALL Engineers. Catalog on request.

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all engine valves  
to match.

## The Machine...the Part...and the Product



## They're fit to fight for Freedom because they're truly FITTED

**T**HE Bendix Pneumatic Shock Struts, which absorb the impact shocks of landing, must not only be thoroughly adequate in their strength, and devoid of all excess weight, but they must be fitted to exacting precision standards. For example, to minimum tolerances and insure the most accurate press or shock fit between piston tubes and the mating forgings, these forgings must be accurately ground. This operation, held to  $\pm .001$  inch, is performed on both bores of the piece pictured above.

## BENDIX PRODUCTS DIVISION

OF BENDIX AVIATION CORPORATION • SOUTH BEND, INDIANA

*The Bendix Pneumatic Shock Struts, employing both air and diesel technology, are just one of the many products of Bendix, which are the heart of many of the aircraft and aircraft parts that equip America.*

**Bendix** **LANDING GEAR EQUIPMENT**  
 AIRPLANE WHEELS AND BRAKES • PNEUMATIC SHOCK STRUTS  
 SWIVELABLE AND STEERABLE TAIL-KNUCKLES • PILOT SEATS

## Lest Congress Forget

IN THE RAPIDLY PASSING PANORAMA of events that constitute the unfolding of our armament program we must examine all of the facts in making an accurate appraisal of progress. Here are a few plain truths that seem to have been forgotten by the Truman Committee in its report on the status of our defense efforts.

Up to the time President Roosevelt asked for 50,000 airplanes the Army and Navy procurement officers had been forced to beg for appropriations to keep the aircraft industry going and maintain a production rate under 500 airplanes per month. Immediately after the President's request, these procurement officers and the members of the old National Defense Advisory Commission worked out a program of orderly expansion of the industry to meet their needs. The first phase of the work was completed and ready for Congressional action in June 1940. Because of political conventions, holidays and other delays, no Congressional action on the new steps required to implement the program, was forthcoming until October of the same year. The willingness of the industry to co-operate and the invention of the letter of intent by the War Department enabled the manufacturers to go to work on expansion plans long before Congress got around to its job.

When the program was first set up it was necessary for the armed services to order aircraft types that were ready for production, but sufficient flexibility was allowed for transition to improved types as they became available. If design had been frozen then, as the Truman Committee seems to advocate now, there might be some justification in criticizing the quality of our aircraft. Design was not frozen, thanks to the foresight of those who created the program. As a result, there is scarcely an important combat plane that has not been improved upon during the past eighteen months. Many more improvements and refinements are in the offing. All successful aerial warfare so far has been conducted with obsolescent aircraft. The notion that ships designing better airplanes to concentrate on production of the types available at any given time will go down to outer defeat.

Our program was built around a group of miniature firms which had demonstrated its ability to deliver on schedule under difficulties. Most of these happened to be the larger manufacturers because large manufacturers usually have the resources to enable them to complete their work on time. But there were smaller companies in the same group and some of the small fry have grown rapidly and have done outstanding jobs. They will be large companies before this war is over. And some of the large companies have had more to give concern in the responsibility of the Army and Navy procurement authorities. No feelings have been spared in their sincere efforts to obtain the largest numbers of the airplanes that have proved their quality in combat, regardless of whose design they happen to be.

When the automotive industry first looked at the aviation job simple common sense dictated that the best way to embark on this brand new manufacturing experience was to follow the methods of those who had been doing it successfully. Conversion of automotive plant facilities to aviation work, at that time would have resulted in debacle. In eighteen months the automotive industry has learned a lot about manufacturing airplanes and engines. Conversion should be somewhat more rapid now, that we venture the prediction that it will not be nearly as rapid as most of its advocates lead us to hope.

The threefold increase in aircraft production in 1940 could not have been accomplished by any other methods than those employed. Nothing but earlier and greater foresight on Capitol Hill could have increased our air power beyond its present strength at this time. The high quality of our flying equipment is indicated daily in the war continuing from the fighting fronts. These facts are sufficiently more eloquent than speeches, overstatements, or reports.

*Julius E. Kantle*



Grumman Wildcat like the one shown here said to have done much to establish the Jay's record at Wake Island, although not as prominently as the Mustang. Good shape might be remembered Wake Island for the great fight put up against overwhelming odds.

## AMERICA AT WAR

Japan's superiority in the air rests mainly on numbers. One lesson learned is the difficulty in recognizing enemy strength and our own under war conditions.

MAIN theater of action in the world war is still at home, although warlike clouds loom both Russian and German air forces. The United States badly outnumbered that we are at war with Germany, because of reinforcement over aerial attacks against the Japanese.

The public is demoralized over apparent Jap air strength, and the question most often asked of Americans is: Why didn't the Army and Navy know that the Japs had all these planes? Why were people allowed to believe that Japs would be a pushover?

There is no single answer, but there are several. The Army is sometimes wrong, like other people. The Army's Intelligence Division wanted that the Russian army couldn't last more than a few months against the Germans. It was wrong. Army never said, officially, that the Japs would be easy. Officers did, privately. And editors, and columnists did. And the public added its own notes to complete whatever distortion of fact there was.

However, the distortion is not as bad as it seems to some. The Japs have control of the air in the Philippines, and even control in the Malay Peninsula, but that is because they are unopposed.

The details do not yet have enough airplanes in the East to drive the enemy out. The United States is the superior in the Japs in carrier-based planes, but the Navy balance of power is such, at this time, that the carrier cannot run the risk of getting close enough to shoot their planes at the

enemy in the Philippines in support of General MacArthur. The Japs have established an base there, and they have the advantage of nearby bases of their own in Hong Kong and the island of Formosa, both about 600 miles distant.

The Navy's unrelenting balance against Japs is brought about, of course, by war in the Atlantic against Germany. What the balance of aircraft carriers is cannot be told. The United States has seven carriers, each carrying about 50 planes in the Japs' 40 each. Japs have been concentrating war ships to carriers, and no doubt now has more than the seven or eight carriers as supposed. One thing you can assume for sure there is a full chain carrier building and can bring out in between the two countries.

It looks like a carrier war in the air or the Pacific, when both sides settle down to death grips. But it will be interesting to watch, as the fight goes on, whether land-based craft will start the show. There's lots of water and long distances. But long range bombers can handle many of the jobs.

Coming back to the comparative hitting power of the U. S. and the Japs, there is no doubt as to the superiority of American and British planes. And as to capacity to build planes, the Allies can release a rate, in 1943, far in excess of Japs.

With a production rate of 5000 to 6000 a month during 1942, the Allies would have a tremendous advantage over Japs, whose production will be 900 a month at the very rate. But the picture is not so bright as that. British and American planes must be distributed to fighting spots all over the world. You can assume only that allocations to the East will be superior to Japs in 1943. Japs have the advantage of being able to keep all her planes from either of her allies, who have none to spare, and no way to get them there.

What happens when Jap and American planes meet is



In this map prepared by RESEARCH to show the area of the Far Eastern conflict. The Japanese air of the war was called in the form of the Pacific. Before last, have selected the Grand World as the headquarters of the United States Air Force. Continue.

well shown in fighting over the Formosa road, which is situated in the Pacific in only months of the Central Pacific. The Japs appear to be so much for the Americans at all.

Just what equipment the Japs have apparently is not yet entirely known to the Army and Navy. Both have recent shipments to help Navy and Air forces to recognize them, but the record does not seem to be complete.

From a fairly diligent collection of all sources, photographs, reports from Chinese press, and the like, it appears that Japs are a complete line of fighters, scouts, light bombers, dive bombers, medium bombers, and two or three types of transports. Apparently the Army and Navy both use the same type, in some cases. Most of the types are bi-planes, but two or three liquid-cooled designs are discernible.

The Japanese appear to have four or five biplanes, among the light scout planes, which might indicate designs several years old. Whereas the United States is making brand new and modern designs the last few years, the Japs have stuck pretty much to old ways. They have quite a number of types with fuel loading gear, indicating old designs, but they also have several dozen, up-to-the-minute looking types.

Eye witnesses at Paul Harbor say they saw Mitsubishi 109's, and the Navy officially said that some bi-planes were seen. It said it supposed that these were P-40's. The Japanese are under lock the Museum. The Japanese are under lock the Museum. The Japanese are under lock the Museum. The Japanese are under lock the Museum.

The next one shows the area which the United States must occupy a point figure may be described as the map on which are shown the positions of the Pacific strategic islands.



Wallace Carroll, and newspaper men who visited Honolulu just after the initial attack, wrote that the Japs have good, no-coded fighters, built under foreign patents, and that some of the planes have belly tanks of reserve fuel, which can be dropped if and when they are attacked. However in Paul Harbor said that one of the Jap planes had an extremely long range. One of this type was shot down in China in the Spring of 1941, and was discovered to have two 28 mm. cannon, and two machine guns, more equipment than American planes had at that time.

The use of Japanese air offensives in time will give some clue to the air force at their command. For instance, in several different days, around 50 planes came over the American fortress at Corregidor in Manila Bay. Once a day of 10 low over the Bataan Road. This is the force that was attacked by three Americans in P-40's with such amazing results.

Using his command to evaluate the losses Captain Colin P. Kelly, who took a biplane, General Henry H. Arnold, Chief of the Air Force, stated that AAF has been (Turn to page 193)

# From the Fight to the Factory

Production in aircraft factories goes up when the boys who fly 'em visit the boys who build 'em.

83 photos by U. S. Army Signal Corps

FIFTEEN THOUSAND men stand in the hot California sun, their eyes riveted on a bluish sky far below. Army officers on the platform in front of them

"The fate of the world is in your hands," he told them.

They pressed closer to the flag-draped platform set up on the concrete assembly trestle.

"Follow soldiers of national defense!" now here he had first addressed them and almost as one they had stood a bit straighter, in their green-covered overalls or in their noted bay sporty slacks.

A few more stepped to the front, their bodies shivering, a heady run behind the first multitude stood now after two of the 7-36 strategists and Army members whom they had helped to build. Cordone continued more calm of the one-sided P-26.

From the speaker's platform the effect looked about him at the great and more abundant young Air Corps pilots and soldiers lined up along a headless line at the very throat of workers in front of him, men of whom were no older than the flight, men 22 or 23.

"We in the Army," he said then, "are soldiers on the firing line. You are soldiers on the production line. We are the makers, you are the industrial base."

He paused, then continued in terse tones.

"All we in the Army and you in the

factory work together loyally and wholeheartedly. America will remain free and unconquerable."

With the words, "True and unaccompanied," the same quest was shattered. The thousands of American youngsters began to cheer, shout and applaud.

"Free and unconquerable" apparently were words which meant much to them.

The speaker was Lt. Col. A. Robert Goodrich, Aide to Under Secretary of War Robert H. Patterson. With him on the platform were Brig. Gen. William G. Ryan, Commander of the 4th Interceptor Command, President Robert C. Groves of Lockheed, Dale Borkhead of the A. F. of L. Army Mechanics' local and representatives of the Labor Division of the Office of Production Administration.

Out as that was the multitude of men and women who work on the day shift at Lockheed's Plant No. 1.

The speech was the climax of a day's visit to "the men who build 'em," the men who fly 'em."

Stands had not yet been raised upon Hamilton or Manilla. Japanese treachery had yet to be avenged, therefore there were few there who at the conclusion of the Calhoun's talk did not realize that the United States' drive of trial was now in force.

The Army men were sure that it was an emergency men who know each other and work together better. This good will visit to Lockheed was part of a four-day tour of as

Gen. Ryan, giving Blanche Patton of Wakefield her check on aluminum working. Women have shown great skill at this work.

Brig. Gen. G. Ryan, Commander of the 4th Interceptor Command on flight field, talks with Owen Blanche of Vega Plant 1.



Gen. Ryan giving Blanche Patton of Wakefield her check on aluminum working. Women have shown great skill at this work.



Army Air Corps party to some of the key aircraft factories in California. Its itinerary indicated two stops at Lockheed, and two at Vega. It covered the Hughes Aircraft plant in Downey, the El Segundo plant of the Douglas Aircraft Company in addition to the huge Douglas plant in Santa Monica.

The visiting party was made up of 20 uniformed pilots and mechanics from Army air bases in Riverside, California, and Albuquerque, New Mexico. With them were members of the staff of Colonel Charles E. Bessmer, Chief of the Air Corps' procurement force in the West Coast. Also on hand was a representative from the Office of the Under Secretary of War in Washington, led by Col. Goodrich.

The visit served a dual purpose. It presented Army Front, most of whom had never seen the inside of an airplane factory, to see how their planes are made. In addition, it permitted tens of thousands of aircraft workers to see and talk with the men flying the planes they build.

It was no conducted "Coke's test." This was more than an inspection of manufacturing processes. This was designed to be a real get-together of men and workers. The Army men, upon entering a plant, scattered in all directions. Some walked through the parts department, a few strode into the welding and machine shops, others staffed assembly methods. All along the way military soldiers spent their time talking with the industrial soldiers, asking the other about his work.

"How does the 7-36 handle to them?" one employee asked of a fly.

"She drinks like a fish, but never gets drunk," was the answer.

And then the fly asked the workers, "What are you making there?"

"That? Oh, that is a part for a roll assembly."

The fly asked a over. Then he said, "We need a lot of them as quick as we can."

The mechanic looked up startled: "You do?" he queried.

"I'd say you've never heard enough planes to trust in," came the reply.

"Well, we'll get down to real," the worker solemnly pledged.

It was the most direct conversation he had seen the workers making how important they and their work were, and how badly needed were their planes they immediately presented in plain as far as they were worth.

"I know my job is important," one fink girl remarked. "Yet I never knew how important it was until today."

The visit to the Southern California arm, following an all night in a double visit to the Boeing Aircraft plant in Seattle, and another visit to four factories turning out airplane parts in



Some of the 11,000 Douglas employees who gathered to hear the Air Corps speakers.

Cleveland, was part of a nation-wide program inaugurated by Under Secretary of War Patterson to bring labor, industry and the Army closer together. Only with a full realization of each other's problems, the Under Secretary feels, can the great "effort" of war that is imperative if we are to defend our country and maintain the true democracy that we are today.

It is not enough to workmen throughout the nation the story of the Army's great dependence upon them, to make the industrial forces of this country realize that they are fully in importance as the military forces in uniform, the Under Secretary insisted this drive in conjunction with a staff of Sidney H. H. man's G.P.M. Labor Division.

This was no invasion of thought

for Mr. Patterson. From the onset of the defense program in the fall of 1940 he has sought to tell the American people the whole story of the preparation program.

The "Judy," as he is affectionately called by his subordinates, thoroughly knows the needs of the armed forces. His knowledge is derived from personal experience. Back in 1936 he enlisted as a private in the National Guard and served along the Mexican border when it was France and rose through the ranks to achieve the post-honorary in a Major.

He was cited for gallantry in eight major engagements in which he took part, and won the Distinguished Service Cross for exceptional heroism.

Referring to the legal provision after

(From page 100)



UNITED STATES civil aircraft production in 1941 again set a new high record, reaching approximately 8,000 planes, a gain of 18.5 per cent over the 6,745 built the year before.

Perhaps an important factor in the material gain, however, is the fact that the light plane gained recognition as a wartime observation ship. Its value in holding the greatest pilot instructor ever created was further demonstrated through the CPTF program during the year. The light plane gained recognition as a wartime observation ship. Its value in holding the greatest pilot instructor ever created was further demonstrated through the CPTF program during the year.

Despite the fact that the war has tended to restrict the civil plane builders' normal market through curtailment of non-military private flying activities, industry officials on the whole are not pessimistic regarding prospects "for the future." Without exception, statements indicate that the industry is ready, willing and able to go all out to win the war—in several cases companies have already been shifted to a full war time operating basis.

Once again, Piper Aircraft Corporation produced the greatest number of civil planes, leading the industry in 1941 with a total of 3,197 craft, compared with 3,067 the year before. A breakdown of 1941 results that Piper built 2,662 Trainers, 406 Cruisers and 268 Coupes, against 1,977 Trainers, 493 Cruisers and 341 Coupes the previous year.

The increase was recorded in the face of a general air of uncertainty regarding private flying prospects throughout the last half of the year which drastically restricted sales to private owners and was a factor behind the decision of many flying school operators to postpone replacement of equipment then in use.

Taylorcraft, which in 1940 showed the sharpest rate of gain to its 524 planes for that year, finished 1941 with production of approximately 1,000 airplanes, of which about 75 per cent was for training purposes. This total was practically duplicated by Aeronca, whose 1940 output was up some 26 per cent to 990 craft, of which 524 were Super Chiefs and 307 were Trainers. Produc-

tion during the second year should be even higher than this figure, for an additional 20,000 square feet of production area and some 130 more employees will soon be added to existing facilities.

Piper, Taylorcraft and Aeronca were among the companies supplying the Army with light planes which so effectively proved their worth as ground tier workhorses during the summer maneuvers throughout the Southern states.

Cessna continued to maintain its enviable production rate during the year, reporting approximately 900,000 in sales of its 7-50 Twins and Aeronca's to Pan American Airways, the CNA and private owners. In addition to keeping ahead of schedule as its governmental contracts.

One of the sharpest gains percentages during 1941 was shown by Beechcraft, whose output jumped from 80 to 330 ships, including five models as follows: 30 Skyhawks powered by 60 hp. Franklin; 45 three-places and 30 two-places. Chaudrons powered by 125 hp. Kew-Kover motors; 20 Instru-

Commercial activity of Miami, for years one of the industry's largest non-producer, was confined to "accepting" of orders or the books at the company refused to concentrate on production of Advanced Trainers for the CPTF program. Already in this category was Ryan, 100 per cent engaged in military work. Also passing this year during the year was the Beech Aircraft Corporation.

Perhaps indicative of future trends, two new plastic bonded plywood ships made their appearance last year. One, the Langley, is a four-place low-wing cabin, jet powered by two 85 hp. Franklin, was designed by Martin Jensen, second-place winner of the Dole race to Hawaii in 1929. The other was the Horizon Trainer, a two-place, tandem advanced trainer carrying the new 125 hp. opposed Lycoming six engine, was first test flown by the veteran Vance Brown on May 1.

While war-time restrictions will continue to drastically curtail private flying the industry looks forward to considerable production again this year. With



Flight of civil planes like these soon will be stopped overhead on defense missions carrying the supplies of the Civil Air Patrol.



## 1941 CIVIL PLANE

## PRODUCTION

Gains registered by "big three" light plane makers—  
"greenhouse" ships win recognition in Army cooperation

## Sets New Record



tion Trainers with the same power plant and size with 90 hp. engines of the same make.

A newcomer to the higher production bracket during 1941 was International Aircraft and Engineering Corporation, of 30 Sepulveda, Cal., producing 244 Cubes Trainers. Of the total, 203 had 65 hp. Continental, 22 carried 60 hp. Franklin, five had Franklin 60s and 13 used Franklin 90s. But one 50 hp. ship was built during the year, and this was powered by Continental.

Only two of the major lightplane manufacturers showed production drops in 1941. Luscombe, hard hit by simultaneous priorities, reduced output to 200 ships from 465 the year before, while Taylorcraft cut production by 50 craft to a total of 182.

Less than two weeks of Piper's release program was represented by the 191 Cubes built up and ready for delivery. This striking photo graphically emphasizes the growing popularity of America's light plane industry.

the air force being engaged to produce from 500,000 to 1,000,000 new, present pilot training programs will have to be greatly expanded. In addition, it is pointed out, the lightplane industry provides an outstanding source of supply for subcontracting work for larger military aircraft.

Normal production will be at least partially maintained, however, for, as one leading manufacturer said, "The Civil Air Patrol will undoubtedly provide a steady market for aircraft, mostly involving the sale of ships to administrative flights under the CAP. The prospect of a greatly enlarged CPTF should also do a great deal to keep the manufacture of light commercial airplanes extremely active during the year."

"The most enthusiastic acceptance of the light airplane by the Army for liaison, reconnaissance, artillery spotting and other similar purposes," he added, "indicates that light planes more likely will be kept busy serving our military interests of their current types.

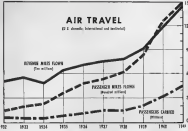


These Taylorcraft Trainers used to Peru to show the modern of a civilian pilot training program the type National Air Academy established in the South American Republic last year. Below, a group of Luscombe Cubes awaiting delivery for delivery.



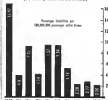
## AIR TRAVEL

(U. S. domestic, international and technical)

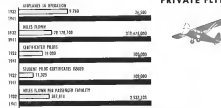


## THE SAFETY RECORD

(U. S. domestic, international and technical)



## PRIVATE FLYING



# The Backbone of Aerial Defense

## Ten Years of Civil Air Expansion

CIVIL air statistics covering the past ten years show how through the last years of the thirties this fast-growing new industry built the groundwork for the vast plane building program which this year gave the Allies indisputable supremacy in the air and in due time bring victory to all the Democracies.

Civil aviation stimulated the technical development of aircraft and equipment, provided trained personnel and improved techniques of operation—in

short, the nucleus of men, machines, airways, airports and manufacturing plants around which has been built an as inevitably short period a military aircraft production program for the United States greater than all the rest of the world combined.

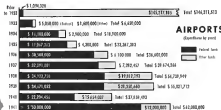
In the preparation of this statistical nation, grateful acknowledgment is made to the Aeronautical Chamber of Commerce of America, the Air Transport Association of America, the Civil Aeronautics Administration and Civil

Aeronautics Board and the National Aeronautics Association for their ready co-operation.

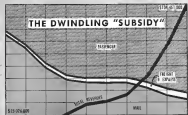
It is regrettable that the complete information upon which to compare final figures for 1941 exists was not available at the time of going to press. However, for those persons desiring to keep a log of these subjects, it is regretted that the final official figures is awaited in the original tabulations as they appear in subsequent issues of *Aviation*.

## AIRPORTS

(Square feet by year)



## THE DWINDLING "SUBSIDY"

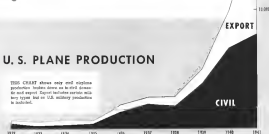


Actually, there is no longer any direct subsidy to aircraft through the mail program. Postal premium lists has become the greatest source of income to airlines. The chart shows relative percentages of domestic airlines and shows increases derived from premium lists and express income since it has been paid. Each national has approximately 100% dependent on the heavy lists has shown; my steadily increasing list revenues over the same period.

AVIATION (Revised 1941)

## U. S. PLANE PRODUCTION

THIS CHART shows only civil airplane production broken down as to civil domestic and export. Export includes certain military types but not U. S. military production is included.





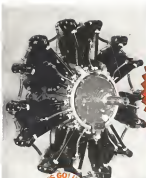
### TEN YEARS OF CIVIL AIR EXPANSION TO JANUARY 1, 1942

<sup>a</sup>Anterior on 1941 census indicates asthma based on latest reports available.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>AIRLINE OPERATIONS</b>											
Airline											
Domestic and foreign	900	902	917	937	973	1,012	1,051	1,093	1,137	1,182	1,227
International	500	511	518	533	557	575	591	607	624	641	658
Total	1,400	1,413	1,435	1,470	1,530	1,587	1,642	1,700	1,761	1,823	1,885
Average number of passengers per flight	100	101	102	103	104	105	106	107	108	109	110
Average load factor (%)	85	86	87	88	89	90	91	92	93	94	95
Aircraft fleet											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger capacity											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue per flight											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue per passenger											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue per passenger per flight											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue per passenger per flight per 100											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
Passenger revenue per passenger per flight per 100 per 100											
Domestic and foreign	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
International	500	550	600	650	700	750	800	850	900	950	1,000
Total	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400</	

[illegible]





Aircraft engine equipped with Timken Roller Arm Bearings. Engines similar to this are used in Air Force training planes.

What will you  
do when wings of  
war become wings  
of commerce?



Timken Roller Arm Bearing Application as used in the above aircraft engine.

Aviation is a grim business today—a business of bombs and bullets. Its greatest opportunity will come after victory; then cargoes of commerce will replace loads of destruction. Then Timken Bearings will help to keep 'em flying for prosperity. Make sure your new airplanes have Timken Bearing protection.

**THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO**

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery. Timken Alloy Steels and Castings and Alloy Steels—Iron Tubing, and Timken Rock Bits.

**TIMKEN**  
TAPERED ROLLER BEARINGS

# Manufacturing

## SECTION OF AVIATION

PRODUCTION • DESIGN • RESEARCH • ENGINEERING



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Approximately named the "Dynamite" by the shop crew, these machines incorporate specially-designed fixtures made with custom-homemade mounted Delta drill heads for drilling the 14 tapered guide holes and support guide hole-drove screw holes in the front casing. Usually not even operated, but waiting, waiting and waiting of these pieces of fabric is performed by the 10-line, close-up with 1000 feet.



## Jacobs Jumps Into Big League

With a phenomenal increase in production achieved since June, 1940, Jacobs is in the midst of preparations to more than double present engine production with construction of a new plant to produce Pratt & Whitney engines under license. . . . By I. A. HARRIS, III.

Chairman of the Board, Jacobs Aircraft Engine Co.

ONE of the greatest expansions in production of previous engines ever accomplished in so short a time," is the way the engineers who have referred to the remarkable achievement of Jacobs Aircraft Engine Co. in stepping up its unit production over several thousand percent in little more than a year.

That showing is the latest chapter in an amazing industrial saga dating back to Hitler's march on Poland. It has involved constant cooperation between the Jacobs organization, the Procurement Planning Division and Air Corps in the War Department, the British Purchasing Commission, the financial backers who made the program possible, and Ford, Buick & Davis, Inc., industrial management engineers added, as to which production control.

The story really began about two years ago when the Air Corps asked all

of the primary airplane and aircraft engine manufacturers to submit bids for producing their "M-Day" plans in fact, drawing requirements for expanding production up to 30 times the maximum capacity of the two existing plants.

The specifications for these plans involved an enormous amount of detail for a standard not only the complete layout, retooling and enlargement of the plant construction's own shop, together with machines, tools, buildings, and so on, but also a complete breakdown of the amount of work to be subcontracted and the names and quantities of the subcontractors.

Many of the larger companies were able to make this study with their own personnel, but the smaller companies, who were just facing the first expansion of British and French orders, were unable to do so.

Among these companies was the Jacobs Aircraft Engine Co., manufacturers of 7-cylinder, air-cooled radial engines ranging from about 225 to 300 hp. The engines were developed by Albert R. Jacobs, who is now vice president and director of engineering. For a long time prior to the expansion that demanded for engines in this category had not averaged more than eight or ten units per month.

Accordingly, it was decided to call in the engineering firm of Ford, Buick & Davis to make the study. The Air Corps gave prompt cooperation and the complete report was submitted April 4, 1940. It was generally acknowledged as one of the most complete and detailed "M-Day" reports which the Air Corps had ever received.

Meanwhile, negotiations with the British Purchasing Commission reached



the stage where a contract for a large number of engines for the Canadian training program seemed reasonably assured and the Air of Ford, Buick & Davis was retained to install production control, rearrange the plant layout, supervise the purchase of additional equipment and make cost studies in connection with estimates for further orders. About a year later, the management contract was extended for the period of the present emergency, with renewal options.

Finally, a contract was secured late on June 18, 1940, with "His Majesty the King in Right of Canada" for the initial mass order. Ford, Buick & Davis went on hand to provide supervision of operations and management consultants services. Immediately, plans went off and plans were rolled up.

Methods and tools of all sizes and descriptions had to be designed. One urgent need was for rapid drill presses. Manufacturers couldn't promise deliveries for months in the future. The engine had to be machined in many respects to adapt it for different mass production. Consequently, to handle this work, to maintain high quality control and to conduct research work to improve machine methods, immediately in the future, the engineering department was greatly expanded.

C. J. "Trey" Abbott, now president; J. Henry Smith, now president and secretary; Al Jacobs and Henry M. McFadden, vice presidents; Donald F. Turner, recently elected vice president in charge of manufacturing and shop superintendent; C. E. Sander held a

This silhouette of a jet section polished to a high finish under the laser lighting process reveals the light machine which results on the surface.



Bo-GalloQ demounting machine with speed reducing drive and fixture for driving the demounting holes in the engine and. The two basic drive is dual drive simultaneously from opposite sides. Motor was built in a distance of 100 ft.



Revolving motor pulley reduced the feeding operation to one-fourth the time measured in a pulling process formerly employed. Two sets on its base are about to turn into the demounting compartment in the engine table. Two others will then move out for mixing.

corner of war. "The devil with waiting," they decided, "if we can't buy tools we'll build them ourselves."

From then on the engine factory was a modified assembly. Nobody wanted by the clock. There was only a long and a change, which opened them on. Jacobs hurried back to the engine lab, published a slide rule and went to work on his drawings. The others pushed the plant additions which have multiplied the floor space. Dan Turner bought a firm out west who had a stock of electric drill bits. He shipped up 200 of them and proceeded to make his own multiple drills out of them. Sander began retooling and installing machinery and fixtures.

All this was done without interrupting production. Hardly by the end the engine rose steadily.

Ground was broken in November for

This big one is intended to both the vertical and horizontal planes and also allows simultaneously in being the case under both the drilling and tapping heads.



This is a greatly expanded section of a standard lathe. Note how it produces a close "fit" on the steel with no evidence of stresses.



a new \$20,000,000 plant which is being financed by the Jacobs Plant Corp. The newest thing is windowless "black-out" design. It will provide over half a million square feet of factory space. Equipment required will cost over \$6,000,000. In this plant Jacobs will build under license 450 hp Pratt & Whitney engines. It will be finished and equipped by July.

This is eloquent testimony to the confidence placed in the Jacobs engineering by government and industry on the basis of its production expansion record of recent months.

Contributing substantially to this achievement was a whole series of engineering and production innovations accomplished by the factory men.

Additional grinders were added for grinding the knife-gee holes in master rods, but they couldn't be obtained within a reasonable length of time. So Turner decided to turn them. The tough steel broke, chipped and dented his tool bit, but finally a diamond-hard tool steel was found which stood up under the grinding task assigned to it. Best of all, however, the time for the tool operation was reduced from about four hours under the old method to a mere 40 minutes the new way.

One and a half hours were required for the polishing operation on the same rods designed to resist fractures and reduce service failures in the engine maincases. They experimented with an apparatus which blasted the surfaces of the rods uniformly with tiny steel balls, producing a dense "skin" on the steel and accomplishing the same purpose. This method, which experience has proved at least as good, and probably an improvement, consumes only six minutes per rod.

Black cylinder on the Jacobs engine has 37 cooling fins which are cast integral with the barrel. Gewiss one-eighth of an inch wide and five-eighths of an inch deep have to be cut out in lathes. Three grooves at a time had to be milled down the maximum practicable number of cuts. However, by utilizing gemstones a turning block like a giant comb was designed which cuts all the grooves in a single machine operation. Black cylinder is thereby turned in one-sixth of the time formerly required, and the lathe, an expensive and bulky piece of machinery, produces nine times as much work.

A prime example of Turner's ingenuity has been dubbed the "Octopus" by its operators. There are two sets of seven tapered guide holes on each of two different levels around the rim of the dome-shaped front portion of the crank-

case. It is a nightmare making, which presents a number of difficult problems in connection with machining and boring.

Turner designed a large hole drilled which he counted seven drillings, each with a two-quadrant lead. Adjusted to one-thirtieths of an inch, fed automatically through a Jig, 34 holes are drilled at one setting. Then compressed air, working through nozzles and cones, cleans and rotates the barrel and a second set of 14 holes are drilled. Coolant floods the work from an elevated funnel above and is sprayed from below to eliminate the ever-present danger of explosion of chips when machining magnesium castings.



Freely rotated cylinders breathing in a streamer through a battery of 534 water jets and baffle for drying and heating the stream. The streamer has three auster jets that blow in 12 lines of air drying.

This machine took several months to build. It cost about \$6,000. To do the same work, we would have needed two special machine tools costing around \$4,700 each—and might still be waiting for them.

The positive assault on cylinders used to take three night shifts longer to dry, depending on the humidity of the air. Now the cylinders are being on a revolving rack and move slowly through a drying oven formed of banks of infrared lamps. The result looks better because it does from the inside outward and the half-day period has been cut to about six minutes, a tremendous saving in production time.

These advances by no means represent the extent of engineering new applications, but are typical of the common-

sense methods by which Albani, McFadden, Turner and Steiner overcome all obstacles to convert a small shop employing around a hundred men into a real mass production aircraft engine plant. Employees have now passed the 1,000 mark, and will reach a peak of 1,500 on a 24-hour schedule when completed additions and the new plant are in full operation.

The picture of things to come is not too clear at present, but I can firmly convince that the life of our company depends on engineering for the future. For the present, we are conducting our financial, managerial and engineering efforts on the soundest possible basis to

ensure a strong and healthy organization to assist future customers. For example, plant additions were built with advance on contracts, and we do not propose to pay dividends until they are all paid for.

At the end of this emergency Jacobs engine will be flying by the thousands in single and twin-engine aircraft throughout the hemisphere. Much of this equipment will continue in the lineages for which it was originally designed. On the other hand, many of the airplanes will find other private and commercial uses before their useful life is ended. There will be a big servicing job to do through the years and we intend that the Jacobs Company shall be equipped to do that job in addition to producing better and better engines.



Through Porthole: Crews of Board After Naval Recovery Service





# How the Greatest Name in Rubber became a Great Name in Aviation



Deliver and sell America to the most powerful nation in the sky, our safety, our freedom, and our record of today and tomorrow is what they have been in the past.

*Goodyear*

TODAY Goodyear is one of the nation's foremost builders of light metal-alloy subassemblies and parts for the mighty new air fleets that will win victory for America.

These are not small products of a rubber company. Neither are they overnight outgrowths of the war production program. How Goodyear comes to be building them is a story of unswerving faith in the future of aerial transportation that goes back to the dawn of aviation.



It began with our development of the first practical airship tire in 1899. Then airplanes were still using primitive undergears—sled-runner skids, or bicycle tires that often burst and tipped off under landing impacts.

The new Goodyear "Aeroplane" tire made take-offs and landings so much easier and safer, many airplanes were using it by 1910.

Next we learned that aviators were complaining about wing coverings. The varnished canvas they used stretched and flapped in flight, retarding speed.

Our solution was the development of a stretchless rubberized fabric, an eight-day job added 3% to an airplane's speed. At the 1911 Chicago Aero Meet nine out of ten planes had Goodyear-covered wings.

This success led us to build a giant 80,000 cubic foot racing balloon of similar fabric—the famous Goodyear 1. In 1913 it won the Pan American International Balloon Race and brought the James Gordon Bennett Cup back to the United States. Goodyear balloons continued to win many races.

So when the World War came, both the Army and Navy turned to us for lighter-than-air patrol and observation craft. More than 40 scouting airships or "blimps," and upwards

of 800 "straw" balloons were delivered to the U. S. forces.



During this war we turned out thousands of airplane tires, and shortly after the war's end Goodyear completed development of the first rubber-covered, bullet-puncture-resisting gasoline tank for airplanes.

After the war Goodyear continued to expand its operations in all branches of aeronautics. We built the Army's first anti-ditch airship, the HS-1. We worked with the Glenn L. Mann Company in forming metal skins for the Navy's first all-metal-frame bomber. We began building our own fleet of blimps, and we acquired the Zeppelin patents.

During this period airplanes were becoming larger, faster and heavier. Smooth, safe landings became difficult on land, high-pressure tires.



Goodyear met this with the low-pressure type Aerobead that has since revolutionized all tire design.

In 1928, when the Navy decided to build two giant rigid airships, they naturally turned to Goodyear as the nation's most experienced builder of airships. In constructing these great ships—the largest aircraft ever built in America—we faced the problem of obtaining stronger duralumin alloys than this country had ever produced.

As a result of Goodyear's efforts to secure stronger, lighter alloys for airship fabrication, America today

produces alloys for airplanes far superior to any known twenty years ago.



During the thirties we developed featherweight magnesium-alloy wheels for transport airplanes, and hydraulic disc brakes that pack tremendous stopping power in small compass.

That it was that Goodyear was ready and able to begin mass production of metal airplane subassemblies when

America first moved to become the arsenal of democracy.

Today Goodyear's great aircraft parts factories are producing complete all-metal wings and tail assemblies, nacelles, doors, ailerons, cabin structures, bullet-puncture-resisting gasoline tanks, wheels and brakes—in ever-growing extent.

Upon this work we are developing all the aeronautical experience and skill acquired in thirty years of pioneering, in full realization that our liberty is not secure until America commands the air.







molded products of plastic materials.

The Chem L. Martin Co. has suggested a test print, Exhibit A, which will facilitate the measurement of design values for molding compounds. A transfer mold and compression mold have been designed by the plastic industry for this purpose. The mechanical properties obtained on the test coupons must be compared with data made on actual airplane parts in order to establish a margin of safety for molded parts. In the case of metal castings, the margin of safety required by ASME is 100 percent when the tensile strength in the test bar is taken as the allowable design value. If a test is made in a finished casting, including the joints in service, a margin of 20 percent is permissible. This is preferable since test bars have higher mechanical properties than castings, which also have different mechanical properties. The ratio of yield strength to tensile strength is also a factor in determining the margin of safety. A test in a casting gives a better picture of the actual mechanical properties. Data on structural molded plastics are sufficient to establish margins for design.

The designer bears his responsibilities as the static properties of a material are given little thought to the dynamic properties except to eliminate as far as possible the sharp corners, edges, and rapid changes in section, which cause concentration of stress and lead before long fatigue. Some materials have greater notch sensitivity than others. The reaction of plastics in compression is similar to that in tension and the behavior has the characteristic appearance shown by a progressive failure. As in the case of static loading, it is advisable to test the finished part or assembly under a flexing load if it is subject to such conditions in service.

The clear plastics, manufactured without the use of pigments, have the mechanical properties which are necessary for parts in the primary structure of an airplane, that is, the structure which is designed to carry the flying and landing loads and the control system. They are in secondary structures is well established. This includes sheet stress as endplates and instrument enclosures, nose sections, instrument panels, and miscellaneous small equipment molded parts. For some of these applications, strength and stiffness are essential, and considerable study can be given to improving the properties so that windows and enclosures can better resist the air loads from windblast and the pressure loads within the case of impinged cabin. The elastic properties are of considerable impor-

tance. A material which can deform under load and recover its original shape after the load is removed is preferable to one which takes a permanent set. Non-elasticity in case of loadings is important. This is affected both by internal stresses introduced in manufacturing and set reduction, and by stresses due to external loads from improper installation.

The semi-fiber composites offer much greater opportunity for high mechanical properties. To date, the highest properties have been achieved with phenol-formaldehyde-wood composites. The forming of large sections from impregnated wood requires rather heavy presses and the equipment, but the aircraft industry has proved that this need not be too costly. The restrictions are that the mechanical properties will be quite satisfactory for bulk, wheels, and structural members of the airplane. Bulk parts can be designed relatively free from sharp bends and compound curves. Combination of impregnated wood with glass and carbon fiber composites may increase the weight penalty. It is possible to obtain a strength-weight



Exhibit A. Molded test coupon for plastic materials suggested by Chem L. Martin Company.

relationship superior to most of the metals now employed in aircraft construction. The impregnated woods are very stable and not subject to swelling from the elements, which is normally subject the entire ply of joined plywood.

Fiberglass, paper, and numerous textile fibers, both natural and synthetic, have attracted more intensive study for aircraft use since they produce materials which are more easily molded. Structural parts, generally, must have practically equal strength at all directions in the plane of the application of the loads. This means that the fibers which are laminated should have equal strength in the warp and the filling, and that fibers must be arranged in alternate layers at

right angles to each other, and any molecular members of weaving fibers must be balanced. As a general rule, the thicker a material the equal weight per square foot, the more efficient will be the structure.

Other characteristics such as moisture absorption, distortion after machining, or with changes in temperature, resistance to fuel, oil, acids, alkalis and ordinary organic solvents, and solubility, are important, but depend upon the particular application and may be modified if warranted by a improvement in the mechanical properties.

Conversely with the development of plastics which meet the engineering requirements for the structural parts of airplanes, the plastic industry must also consider the problem of retaining pureness. The airplane industry will pay more to affect a saving of a pound in structural weight than any other branch of the transportation industry, but the aircraft can't stand all to lose from the materials which will come from that saving. The number of parts to be manufactured from a mold will be relatively small, often only a few hundred. Therefore, the cost may be the determining factor in the selection of a material. Plastics which can be molded at formed in dies of low cost will have the advantage. Production also means something easy parts to make a finished structure. This involves the problems of joint design and reliable adhesives. A material may have satisfactory mechanical properties but if it cannot be fabricated into a structure the applications are seriously restricted.

The development of plastics for structural purposes is not easy. It is similar in many respects to the development of metal materials alloys. Fabricating research and often a large scale work which trial and error are necessary to obtain the laboratory product and then a rigorous service test before it is accepted by engineers. The aim should be to take full advantage of the wide range and versatile characteristics of these synthetic materials to create a large surplus and not simply to substitute materials for the present equipment.

In the utilization of plastics, the industry can expect the engineer to be assisted by the engineering, but in return, the plastics industry must be able to supply data on the engineering properties of its products.

#### APPENDIX

Methods Of Testing For Mechanical And Physical Properties Of Plastics

(This is page 40)



## Steel in Stock for War Planes Production . . .

Steel for planes, steel for planes, steel for plane equipment and maintenance . . . practically all of the thousand-and-one vital uses for steel in America's gigantic plane production are served by the wide range of kinds, shapes and sizes in Ryerson stock.

True, Ryerson service is not normal—but all of the vast resources and broad experience of the hundred-year-old Ryerson organization have been placed at aviation's command. Today, as always, aviation can depend on Ryerson to deliver the steel that's needed, if it's anywhere to be had!

For steel requirements up to the nearest Ryerson plant. You'll get prompt action whether it is a problem of procurement, application or fabrication we will be glad to work with you, with real help the solution of your problem of exactly the kind, shape and size you need is not available. Stock list catalog mailed on request.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

**RYERSON** *Certified* **STEELS**





Brig. Gen. Lewis B. Hershey, Director of Selective Service, as he testified before the House Military Affairs Committee in support of the accelerated entrance training for registration of all men from 18 to 65 years of age.

## Selective Service and the Aircraft Worker

By  
BRIG. GEN.  
LEWIS B. HERSHEY

**M**OST of the armed-armed fighting in this war will be done by the young men of America. Modern warfare is of such a nature that it requires the greatest in physical stamina, coordination, and reflex action. Generally speaking, the stream of men for modern war has service in its teenage years to their age.

Under recent legislation, more than 28 million men between the ages of 20 and 44, inclusive, are liable for military service. There are an additional 13 million men 18 and 19 years of age, and 45 to 65 years of age, who are in the register. This gives America a total manpower of some 41 millions of men who must do the tasks that are necessary in total war for total victory.

Selective Service in total war is not going to deviate from the fundamental principles which governed its operations during the peacetime training program. Men will continue to be deferred from military service when they have dependents. Men will continue to be deferred from military service when they are "necessary men," and are difficult or impossible to replace.

However, management and industry must recognize that the man who is deferred as a necessary man is deferred temporarily and each employer has the

responsibility to secure and train replacements for such deferred men who are physically fit and would otherwise be available for military service. Occupational deferments are usually for a 6-month period. When absolutely necessary, such deferment may be extended for additional 6-month periods, but only where their continuance in the present job is absolutely necessary for the maintenance of our national health, safety, and interest.

There is an adequate supply of replacements for necessary men among those who are physically unfit for military service, those who are presently deferred because they have dependents, those who are above the age liable for military service—45 to 65—and in many cases among the women of this great country.

Employers must be honest and sincere in their requests for deferments and must meet such requests in cases of men who are in fact necessary. No industry or activity, no matter how closely identified with national production for war, can ever become a refuge for those who seek to avoid their obligation to their country in its hour of need.

There is an adequate supply of replacements for necessary men among those who are physically unfit for military service, those who are presently deferred because they have dependents, those who are above the age liable for military service—45 to 65—and in many cases among the women of this great country.

**AVIATION IS A YOUNG MAN'S INDUSTRY.** The percentage of workers within the age brackets prescribed for selective service is exceptionally high. The immediate need for skill operator numbers of new workers is fully recognized and personnel training must be increased far beyond the scale now contemplated. It is the serious need of Selective Service officials to build up our armed forces with the least possible expenditure of essential industrial production. But industry must appreciate the problems of Selective Service and co-operate with them in their important task. Manufacturers must prepare themselves to make replacements and to increase the percentages of women and older men in their organizations. To guide management in planning for the future, Brig. Gen. Lewis B. Hershey, Director of Selective Service, has written the following statement of policy for our readers.

## For More Planes per Day To Speed Victory THOMPSON PRECISION GRINDERS



Model 42, also 24"x36"x48" Hydraulic Surface Grinders for grinding heavy work. Give the extreme responsiveness of design which insures highest degree of accuracy and finish. Few months' continuous use give operator complete freedom of operation.



Type T-4 48" Hydraulic Grinders in Ideal for Tool Room Work. Give extremely high speed—its universal ability to work in length of less than 200"—and its outstanding versatility plus it is a half of its own. Two speed motor provides wheel speeds of 1750 and 3400.



Fully Outfitted 12"x48" Jeweler Grinders for grinding all types of surface finishes. Both grinding and polishing operations are accomplished on the machine. A unique feature is the automatic both hands which accurately positions the table for grinding work tools of the bench.



Model 28, also 6"x12"x48", for Tool Room and production purposes. Features hydraulic rapid traverse balanced control, smooth, shockless hydraulic table drive with infinite speeds available within a range of 75 to 120 feet per minute. Bone is of complete instructions with full-size control system.



The tool and machine department at Pitman & Martin, Inc.

## Organizing Little Plants For Big Production

By JACK FROST, Executive Secretary, Aircraft Parts Manufacturing Association

WITH world conditions as they are at the present time it is absolutely essential that small business firms having common interests voluntarily band together in trade associations. This is particularly true of the various small shops and businesses of many kinds which act as sub-contractors in the aircraft industry. Plagued with production problems, labor troubles, and other headaches, these people need the strength of a united front in order to make the maximum contribution to all-out defense production. They also need a coordinated effort in dealing with government agencies and in protecting themselves against unfair or abusive interference with their normal business procedures.

It has been difficult for many small business people to appreciate exactly why they should go to the trouble and expense of supporting a trade association. But they are now beginning to see that as many government agencies are concerned with the problems of the defense effort being made at the present time that for purposes of self-defense



Jack Frost

alone such an association is worth while.

Our association has many functions but the most important are those connected with its work as a clearing house among the various members to disseminate information on mutual problems, and as a basic office for incorporating

our problems in the various agencies, of government, and interpreting the acts of these same agencies for our individual members.

At the same time there are a number of things that our association, or any such association, probably cannot do. We cannot band together to establish wage schedules or working conditions. This might be interpreted as an anti-labor activity. And we can't serve as a clearing house for placing orders among our members, at least officially, although informally it is possible to be of great help along such lines. But any effort to set up a so-called "bidding bureau" for allocation of business among our members, however efficient such a scheme might prove, would be open to criticism as a conspiracy in restraint of trade.

This association was started in June 1940, and now has a membership of more than 100 Southern California firms. Although we have but 300 members, we actually represent the entire aircraft parts producing and sub-assembling industry of this area, including a total of some 350 firms. The importance of this branch of the aviation industry may be illustrated by citing a few figures which are approximately correct as of November 1, 1942.

The total number of employees of the aircraft parts manufacturers of this

Cleaning Department of Howell Aircraft Die Casting Corp. and view of some of the machines used in use.



CLARK serves the Nation on the flying fields of War and —



*— in the arsenals of Production and —*



on the airways of Peace

CLARK TRUSTRATOR Division of  
Clark Equipment Company, Battle Creek, Michigan  
Manufacturers of Industrial Trucks and Tractors

MANUFACTURING

## Seventy Percent Ahead of Schedule

With the slogan "Remember Pearl Harbor" ringing in their ears, Boeing mechanics really went to work and stepped up production to a new high.

"BUSINESS AS USUAL" is a forgotten phrase at the Boeing Aircraft Co. plant in Seattle. Already in operation 24 hours a day, since dawn a week, workers were so electrified by Japan's sudden assault in the neighboring Pacific that Boeing's accelerated delivery schedule was exceeded 70 percent during December.

Boeing's overhead reading, "Remember Pearl Harbor" instantly remind every worker that taking days in his very hands are the pieces of the instruments which may well mean the final loss of defense for all that he holds worldwide in life. He knows beyond doubt that his Flying Fortress represents the balance of power which eventually will decide the issue between the two armed camps in this worldwide struggle.

On their solemn heads last month, these representative American workers found this cheering New Year's message from Brig. Gen. George C. Kenney, Air Corps Material Division, U. S. Army Air Corps:

"The Boeing Company has responded to the emergency in an unparalleled manner and each and every man in the organization is to be congratulated for his part in increasing the plant's output."



Fortifier of the hemisphere. These giant B-29 Flying Fortresses are now in mass production.

Delivered wing sections with engine nacelles and landing gear support being assembled into the giant wing jet on the left.



Below: Quantity production methods and specialized effort on the part of victors enabled Boeing to exceed accelerated delivery schedules by an additional 70 percent during December. Boeing is on a 24-hour day, 10-day week schedule.



Right: One of the first mass-produced gliders assembled by the War Department since outbreak of war. This view of the Boeing plant reveals some size of the volume of heavy business moving across the country lines.



## Baynes Speed Range Indicator

A matter of very critical consideration in aviation, as has been found by aerial experience in maneuvers at high altitudes, is the question of available speed range. In steady flight, the indicated stalling speed of a particular plane is known, and the pilot is careful to fly at a safe margin above this speed. The difference between this known speed and the actual air speed is indicated by the A. S. I. in the margin of speed at hand over the stalling speed on steady flight.

When the aircraft is turning with a steep angle of bank, however, the stalling speed is not the same as in steady flight, and may have to be increased to such an extent that this margin of speed, or speed range between stalling and flying speed, may be reduced to an extent that will cause the plane to stall during a steeply banked turn or fail to pull out of a dive. It appears desirable, therefore, that the pilot should have some means of knowing what his speed range really is for any condition of flight and in any altitude.

For this purpose an instrument has been developed in England, the Services and manufacturers at which are R. B. Pullin & Co., Ltd., called the Baynes Speed Range Indicator. It is handled in French territory by French T. Courty of Cote Breve, Inc., 120 Broadway, New York, N. Y.

The conditions for which the instrument was developed are described as follows:

The stalling speed of an airplane is proportional to the square root of the wing loading, when an airplane is in a stall, it can turn or pull out of a dive if the wing loading is much increased and therefore the stalling speed is increased.

If it represents the gravitational force per unit of mass and a coefficient lower per unit of mass due to turning or pulling out of a dive, the total force per unit of mass to be supported by the wings is the resultant of  $g$  and  $a$  and can be called  $G$ . Since wing loading is proportional to  $G$  the stalling speed is proportional to  $\sqrt{G}$ .

Thus a high speed airplane in a small turn bank, necessitating a steep angle of bank, may have a value for  $G$  as much as 6 X  $G$  during the turn. The stalling speed during the turn is in that case increased in the proportion of  $\sqrt{6}$  or 2.45 times normal stalling speed, which is equivalent to a maximum altitude in about 200 mph, and as the flying speed during the turn may have

been reduced to a figure not much above this speed there is a danger of a stalling place without warning. The same thing may happen when pulling out of a dive, the stalling speed may increase to two or three times normal due to the increase in the value of  $G$  with the result that the machine stalls and fails to pull out of the dive. Furthermore, as altitude the stalling speed has increased in the ratio of the square root of the relative density, and as the maximum speed also becomes less above the altitude at which the engine is supercharged the speed range between stalling and flying is reduced for all values of  $G$ .

The proposed instrument comprises a normal A. S. I. with an additional red pointer coincident with the A. S. I. pointer when in set at the known steady flight stalling speed, (engine on, flap



The Mania long range fighter in stock shows use of a 4-cylinder constant-speed propeller.

## Mania Mock-Up.

Wood mock-up of that work is being continued in development of the Mania long range fighter, a novel military design which incorporates the famous Davis wing. Already demonstrated on the Consolidated B-24, the Davis wing is applied in the Mania by the formation of having been adapted to the design by David R. Davis himself. Outstanding feature of the resulting plane is the high taper ratio and unique hook shape of the wing tips. The high taper is used in order to achieve structural efficiency and maneuverability, while the unusual wing tips are designed to prevent tip stalling, usually associated with wings of high taper. In place from the leading edges of the wing sweeps sharply back ahead to the wing tip and then curves sharply in a straight up-sweep line giving the effect of a forward sweep at the tips, especially as there is more forward taper of the trailing edge.

Detailed specifications of the Mania are not available, but it is known to have a wing span of about 50 ft. and to be designed for the Allison 1140 h.p.

engine, which is to be carried near the G.G. and drive counter-rotating propellers in the rear. Armament is to include four cannons and four machine guns. Range of 3500 mi. and top speed of 425 mph is predicted.



Engine location is directly behind the globe cockpit in the Mania fighter. An Allison 1140 h.p. will be installed, giving a range of 3500 miles.

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YODER Gun Type BENDING MACHINES (3) are in popular use to produce glider bar bends. They bring roll formed moldings (sections of reinforcing members, etc.) to complete curves. The straight moldings are fed into the machine and emerge correctly curved to form Y-shaped curves and also bar bends in form of required. These are used in these machines.

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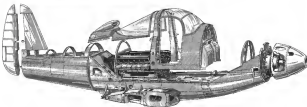
YODER has generally made the roll forming machine and a unit to cut the part automatically to length. Plans are also available to provide for stock or send a container like being in stock.

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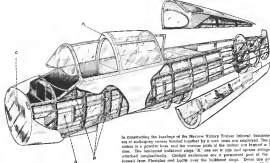


AVIATION once again offers the most complete presentation of its kind in this country of perspective drawings and cutaway sketches, including structural details, of landing gear, fuselages, components and various sub-assemblies.

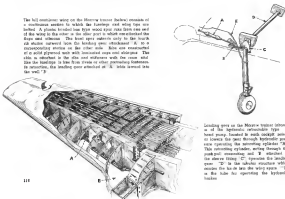


The exploded view of the Ball Aerospace bearings, which is supplied from Aircraft Products, clearly shows the washdown features of 1100 psi. Allcon agrees just off of the job in the metal bearings section. Weighing 60 lb., a 300 stainless steel assembly the drive from the engine is a gear box located in the rear. This shaft is supported in a metal housing. Ball is now more anxious the metal housing has two more months.

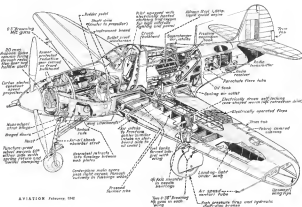
Impregnated beams in the heads of the design. Transverse bracing provides the "wing through" for the assembled wing panels. This structure is of steel because of the heavy construction of loads imposed upon it. Fuselage covering in the center section shows the longitudinal beams in slanted struts covering which provides easy access to the engine, cockpit equipment, seats and instrument.



Construction details of the Ball P-30 Airplane are graphically shown in this color story, and every reduction from destruction, the British conventional weekly. It will be noticed that a 30-ton, engine is installed by the British. The R. & F. is said to have the stiffer engine engine, which has a higher rate of fire and has a greater supply of ammunition than is carried there is possible with a 30-ton.

[illegible][illegible]

Leading gear in the Moxon tractor consists of the Lepidoptera reductio type A hand pump, located in each cockpit, which actuates the gear through Lepidoptera gear case operating the rotating cylinder "B". This rotating cylinder, acting through the push-pull connecting rod "C" attached to the shifter linkage "D", operates the leading gear "E". In the tubular structure which encloses the handle the wire spring "F" in the tube for operating the Lepidoptera handle.



AVIATION February 1942



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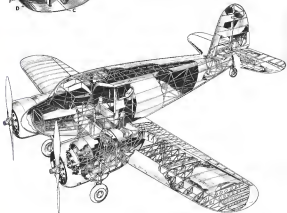


The Douglas DC4 having been purchased by the Japanese, hydraulic models, and very heavy landing gear, may possibly be in service with the Japanese air force. One of the factors that will be interesting to them is that the landing gear, shown at left, starting at the top, the main landing gear strut, 'A', is supported by the fuselage frame, 'B', leading to the wing structure. These bracing on the strut by means of a modified steel fitting, 'C'. This fitting is split to prevent removal from the strut end, is held together by steel through bolts, 'D'. 'E', an armature shown in the side view, in which the torque solenoid, 'F', is attached at the bottom. These are large mechanical steel fittings. Hydraulic bracing lines are at 'G', with 'H' being a fitting to secure the lines while pulling. Lines, 'H', are not in contact of the bracing down, are provided because of the intense heat generated.



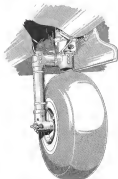
The piston and rod of the Agon (formerly P-47) engine, available in service, is shown at left. The piston and connecting rod are at 'A', while the connecting rod is shown at 'B'. The shaft 'C' is in connection with the drive shaft from the engine located behind the piston, in the front propeller and may have small holes in the case. Outside also of the shaft is at 'D'. The solenoid is attached by means 'E' shown in photo 'F' is the piston.

The engine, P-47, is shown in a side view (below). Many construction elements (solenoid, torque solenoid, and other) are shown. The landing gear is shown in a side view (below). The landing gear is shown in a side view (below). The landing gear is shown in a side view (below).



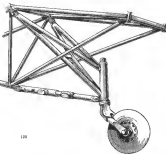


Modified from the previous structure shown in AVIATION'S February, 1941, drawing, the latest Type 273 landing gear is illustrated below. The principal change is the strengthening of the horizontal member which carries the wheel carrier forward in order to decrease the possibility of bending stresses in landing. A further cover is also installed over the main member of the shock strut.



Shockstrut assembly of the Martin 145MP main landing gear are shown above. As the wheel goes down or retracts, the doors open or close by means of bars extending into slots in the doors and over hinges which are visible in the drawing on the next page.

The Martin 145P main plane employs 2024S welded tubing in the landing structure. In the tail wheel landing structure (shown) the vertical wheel member is provided with a flexible horizontal shock strut which is attached by hinges to both the vertical member and the fuselage. The shock strut allows shock load (not installed in the drawing) to absorb the loads. A tubular frame, welded to the fuselage structure, is connected by hinges to the landing frame which, together with the horizontal shock strut, provides a strong flexible tail wheel structure.



The tail structure of the Ryan SE-4 trainer is a welded framework (shown) in the drawing at right which is covered by fabric.

AVIATION, February, 1942

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AVIATION, February, 1942

121



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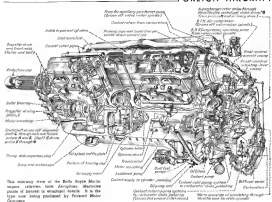
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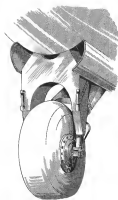
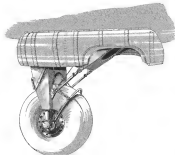
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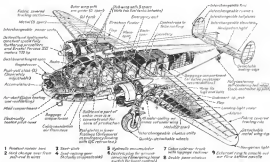
## FOREIGN AIRCRAFT



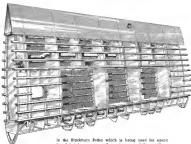
At right and below are shown front and side views of the Romberg-Papez Redline loading crane. A simple suspension system is used for carrying out all the main work. This is said to be the largest sailing of its kind in the world. With the heavy loads, maintenance problems have diminished against study. The steel loads which are now carried have made necessary increased strength in all loading gear fittings together with the appropriate design of structural members.



## FOREIGN AIRCRAFT



The full-fledged DE 90 Finnmark Transport is shown in the midway descent interval, underway from Arendal. Powered by two 232 hp. Isuzu Petrols XVA engines, it has a span of 76 ft., length of 114 ft., 30 in., and draft 12 ft. Weight empty is 35,000 lb. and gross weight 17,000 lb. See spot location in *Arctic & Pacific News*'s table page 20.



The steel gun barrel of the Armstrong Whitworth Whaling gun, is guarded with a door which makes it secure and quieting for the gunner to stow his machine. An aperture for the gun is also located through the door which can be pulled shut by means of the lanyard attached to the lower side.



In the *Blindfishes* *Betta* which is being used for sport based breeding purposes, the male species of the ornamental variety (show) have lobes known as connected by a single line of roots to each edge of the anal/ventral scales. Tubular structures are not employed through which the show elements are transmitted to the structures. These structures are located in the skin by fingered appendages designed to fit into the tubular diameter of the tubes and are inserted through the loops at each side. These tail fin scales are provided in this ornamental structure which are attached from an anterior to the fin.

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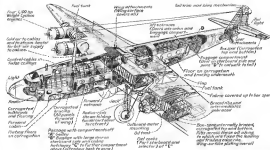
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## ROUGH SET SEALING COUPLINGS

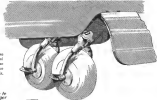


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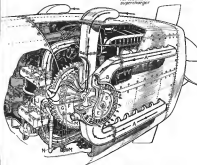


Insulated details of the Armstrong Whitworth design are shown in the cutaway view above. Designed for service between Britain and India, almost 400,000 miles were covered before the war although only about two were built. With a span of 120 ft, length of 161 ft, and height of 100 ft, gross weight is 60,000 lb and weight empty 22,000 lb. *Between two continents*

The Great Stirring heavy loader, which probably carries the largest loads of any skid-type skidder, has a double wheel tail loading gear of the full revolving type. As shown in the drawing at left, the skidder can turn at right angles to the landscape and was loaded in order to carry the great loads, something like 15,000 lb. space for the loaded photo.



*Alle Angaben der  
Anzeigenkunden*

[illegible]

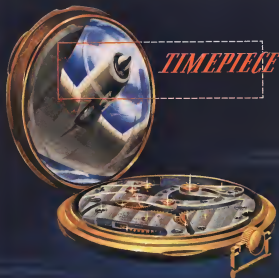
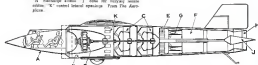


In the Curtiss-Copied jet propeller airplane (above and below), a novel dual action along the entire length of the fuselage. In the forward portion of the fuselage, a turbine driven by the engine produces a pressure increase which causes an air flow toward the aft portion of the fuselage. This flow first enters the engine and then the exhaust gases which increase the thrust value and make possible an expansion toward the aft portion. The expansion is then increased by the injection of fuel which is ignited in the vicinity of the aft nozzle. The thrust needed for the airplane is therefore created by the turbine, as the gas flow used by the expansion of the air and gases situated behind

it as the other. Contact of the propeller is by means of a drive system in the aft view, where it is connected to the propeller shaft on the end of a shaft. By this means the mechanical stress of the jet engine may be reduced, thus reducing the speed, and a part of the energy is lost through engine cooling and in the exhaust gas also is increased. This type of propulsion reveals its limitations particularly at speeds approaching the velocity of sound. As a rule, the speed of the surface of the turbine intake is lower than the flying speed as a result of which the impeller blade can operate at a higher degree of efficiency than the propeller blade of a conventional airplane.



This sectioned airplane (below) illustrates the jet propeller design of the Curtiss-Copied airplane. It has been reported that a jet propeller airplane has now been built in the form of a jet propeller. It will be seen that the jet design, based on a French patent obtained by the Curtiss Aircraft Company in 1911, differs somewhat from preceding developments. The following is the summary of the jet design: A, rear intake; B, exhaust system; C, turbine engine; D, exhaust system; E, exhaust system; F, exhaust system; G, exhaust system; H, exhaust system; I, exhaust system; J, exhaust system; K, exhaust system; L, exhaust system; M, exhaust system; N, exhaust system; O, exhaust system; P, exhaust system; Q, exhaust system; R, exhaust system; S, exhaust system; T, exhaust system; U, exhaust system; V, exhaust system; W, exhaust system; X, exhaust system; Y, exhaust system; Z, exhaust system; AA, exhaust system; AB, exhaust system; AC, exhaust system; AD, exhaust system; AE, exhaust system; AF, exhaust system; AG, exhaust system; AH, exhaust system; AI, exhaust system; AJ, exhaust system; AK, exhaust system; AL, exhaust system; AM, exhaust system; AN, exhaust system; AO, exhaust system; AP, exhaust system; AQ, exhaust system; AR, exhaust system; AS, exhaust system; AT, exhaust system; AU, exhaust system; AV, exhaust system; AW, exhaust system; AX, exhaust system; 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GK, exhaust system; GL, exhaust system; GM, exhaust system; GN, exhaust system; GO, exhaust system; GP, exhaust system; GP, exhaust system; GQ, exhaust system; GR, exhaust system; GS, exhaust system; GT, exhaust system; GU, exhaust system; GV, exhaust system; GV, exhaust system; GW, exhaust system; GX, exhaust system; GY, exhaust system; GZ, exhaust system; HA, exhaust system; HB, exhaust system; HC, exhaust system; HD, exhaust system; HE, exhaust system; HF, exhaust system; HG, exhaust system; HH, exhaust system; HI, exhaust system; HJ, exhaust system; HK, exhaust system; HL, exhaust system; HM, exhaust system; HN, exhaust system; HO, exhaust system; HP, exhaust system; HP, exhaust system; HQ, exhaust system; HR, exhaust system; HS, exhaust system; HT, exhaust system; HU, exhaust system; HV, exhaust system; HV, exhaust system; HW, exhaust system; HX, exhaust system; HY, exhaust system; HZ, exhaust system; IA, exhaust system; IB, exhaust system; IC, exhaust system; ID, exhaust system; IE, exhaust system; IF, exhaust system; IG, exhaust system; IH, exhaust system; II, exhaust system; IJ, exhaust system; IK, exhaust system; IL, exhaust system; IM, exhaust system; IN, exhaust system; IO, exhaust system; IP, exhaust system; IP, exhaust system; IQ, exhaust system; IR, exhaust system; IS, exhaust system; IT, exhaust system; IU, exhaust system; IV, exhaust system; IV, exhaust system; IW, exhaust system; IX, exhaust system; IY, exhaust system; IZ, exhaust system; JA, exhaust system; JB, exhaust system; JC, exhaust system; JD, exhaust system; JE, exhaust system; JF, exhaust system; JG, exhaust system; JH, exhaust system; JI, exhaust system; JJ, exhaust system; JK, exhaust system; JL, exhaust system; JM, exhaust system; JN, exhaust system; JO, exhaust system; JP, exhaust system; JP, exhaust system; JQ, exhaust system; JR, exhaust system; JS, exhaust system; JT, exhaust system; JU, exhaust system; JV, exhaust system; JV, exhaust system; JW, exhaust system; JX, exhaust system; JY, exhaust system; JZ, exhaust system; KA, exhaust system; KB, exhaust system; KC, exhaust system; KD, exhaust system; KE, exhaust system; KF, exhaust system; KG, exhaust system; KH, exhaust system; KI, exhaust system; KJ, exhaust system; KK, exhaust system; KL, exhaust system; KM, exhaust system; KN, exhaust system; KO, exhaust system; KP, exhaust system; KP, exhaust system; KQ, exhaust system; KR, exhaust system; KS, exhaust system; KT, exhaust system; KU, exhaust system; KV, exhaust system; KV, exhaust system; KW, exhaust system; KX, exhaust system; KY, exhaust system; KZ, exhaust system; LA, exhaust system; LB, exhaust system; LC, exhaust system; LD, exhaust system; LE, exhaust system; LF, exhaust system; LG, exhaust system; LH, exhaust system; LI, exhaust system; LJ, exhaust system; LK, exhaust system; LL, exhaust system; LM, exhaust system; LN, exhaust system; LO, exhaust system; LP, exhaust system; LP, exhaust system; LQ, exhaust system; LR, exhaust system; LS, exhaust system; 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UR, exhaust system; US, exhaust system; UT, exhaust system; UY, exhaust system; UV, exhaust system; UV, exhaust system; UW, exhaust system; UX, exhaust system; UY, exhaust system; UZ, exhaust system; VA, exhaust system; VB, exhaust system; VC, exhaust system; VD, exhaust system; VE, exhaust system; VF, exhaust system; VG, exhaust system; VH, exhaust system; VI, exhaust system; VJ, exhaust system; VK, exhaust system; VL, exhaust system; VM, exhaust system; VN, exhaust system; VO, exhaust system; VP, exhaust system; VP, exhaust system; VQ, exhaust system; VR, exhaust system; VS, exhaust system; VT, exhaust system; VU, exhaust system; VV, exhaust system; VV, exhaust system; VW, exhaust system; VX, exhaust system; VY, exhaust system; VZ, exhaust system; WA, exhaust system; WB, exhaust system; WC, exhaust system; WD, exhaust system; WE, exhaust system; WF, exhaust system; WG, exhaust system; WH, exhaust system; WI, exhaust system; WJ, exhaust system; WK, exhaust system; WL, exhaust system; WM, exhaust system; WN, exhaust system; WO, exhaust system; WP, exhaust system; WP, exhaust system; WQ, exhaust system; WR, exhaust system; WS, exhaust system; WT, exhaust system; WU, exhaust system; WV, exhaust system; WV, exhaust system; WW, exhaust system; WX, exhaust system; WY, exhaust system; WZ, exhaust system; XA, exhaust system; XB, exhaust system; XC, exhaust system; XD, exhaust system; XE, exhaust system; XF, exhaust system; XG, exhaust system; XH, exhaust system; XI, exhaust system; XJ, exhaust system; XK, exhaust system; XL, exhaust system; XM, exhaust system; XN, exhaust system; XO, exhaust system; XP, exhaust system; XP, exhaust system; XQ, exhaust system; XR, exhaust system; XS, exhaust system; XT, exhaust system; XU, exhaust system; XV, exhaust system; XV, exhaust system; XW, exhaust system; XX, exhaust system; XY, exhaust system; XZ, exhaust system; YA, exhaust system; YB, exhaust system; YC, exhaust system; YD, exhaust system; YE, exhaust system; YF, exhaust system; YG, exhaust system; YH, exhaust system; YI, exhaust system; YJ, exhaust system; YK, exhaust system; YL, exhaust system; YM, exhaust system; YN, exhaust system; YO, exhaust system; YP, exhaust system; YP, exhaust system; YQ, exhaust system; YR, exhaust system; YS, exhaust system; YT, exhaust system; YU, exhaust system; YV, exhaust system; YV, exhaust system; YW, exhaust system; YX, exhaust system; YY, exhaust system; YZ, exhaust system; ZA, exhaust system; ZB, exhaust system; ZC, exhaust system; ZD, exhaust system; ZE, exhaust system; ZF, exhaust system; ZG, exhaust system; ZH, exhaust system; ZI, exhaust system; ZJ, exhaust system; ZK, exhaust system; ZL, exhaust system; ZM, exhaust system; ZN, exhaust system; ZO, exhaust system; ZP, exhaust system; ZP, exhaust system; ZQ, exhaust system; ZR, exhaust system; ZS, exhaust system; ZT, exhaust system; ZU, exhaust system; ZV, exhaust system; ZV, exhaust system; ZW, exhaust system; ZX, exhaust system; ZY, exhaust system; ZZ, exhaust system.



In their respective fields, a fine watch and a Cyclone engine represent the utmost in skill, accuracy, and accuracy. But while the watch merely ticks away fleeting time, its powerful counterpart is saving hours which would otherwise be lost forever. Watchers long ago reached their maximum of utility, but today Wright is preparing even greater time-saving engines to haul the huge air cargo of tomorrow.

**WRIGHT** *Aircraft Engines*



Boat shown with Boat Self-Locking Nut

## How Edo Cuts Weight and Licks a Salt-water Problem

Smooth water in a landing surface produces as much shock at 60 m.p.h. as concrete. A choppy sea multiplies the shock into extraordinary stress and strain on all post-ten designs.

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comes a permanent, integral part of the fast.

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Boon Clamped Nut ("Grip the Fast")

# BOOTS

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# Aviation In A War Economy

By SELIG ALTSCHUL

WITH aerial prices selling good way to other industries, the war's subsequent behavior attempted to again approve the outlook for American industry. Our country's full-throated shift to a war economy set in motion many new currents as well as strengthening other movements already under way.

The aircraft industry is definitely in the forefront of the war economy. It is estimated that \$55,000,000,000 worth of airplanes a year. The extent of expansion in aircraft facilities and production is to be governed by the requirements of building 40,000 planes, 40,000 of the same type—this year. The statement of this program will obviously involve super-normal efforts as the part of the aircraft industry. It is not for this department to determine whether or not this announced schedule will be realized.

This much is certain. The coming aircraft plants will not want for lack of buyers. Further, still more expansion is to follow along with the conversion of other industrial plants to war, aircraft manufacturers. Steps due to it may have been, post production will appear small in comparison with what lies ahead. It is also a safe assertion that aircraft facilities will be of the low profit margin variety and substantial loss have to take a heavy toll of the earnings margin.

Such is the broad outline surrounding the aircraft industry in a country at war. How did the market value of this? After the shock meeting in the first hour of selling had subsided, aircraft securities experienced a quick rebound from their lows. Argentine investor opinion appears to say that despite low profit margins and high taxes, aircraft equities at present prices represented sound value. The course of future prices will be largely influenced by the features of war. This in turn will have a direct bearing on the duration of the war and its relation to the aircraft industry. (Continued, October, 1941)

The market action of representative aircraft issues is illustrated in Table I. It is interesting to note that such stocks as Boeing, Consolidated and Lockheed at no time during the year reached their previous lows at the year. All aircraft issues at the 1941 year-end virtually recovered the market declines of December, 1940. The month, January, 1941 aircraft prices sustained their upward trend.

The accompanying table also affords ready comparison of the relative action of the leading aircraft issues. Clearly the most satisfactory decline, 1941 were Consolidated and Boeing, both leading the year at highest levels than a year previous. To many market observers and analysts, the action of Martin was a worthy flow of materials. This investor in this company may also take solace in the fact that the various Government agencies will be there assisting and reinforcing aid where required.

The season of annual reports will soon be at hand. Aircraft accounts, however, promise to be devoid of the voluminous detail to compare to previous reports in many instances. This new departure, stemming from the Government's bias on divulging information, will make it increasingly difficult for stockholders to follow the affairs of their corporations. More important, managements will now be in a position, if so inclined, to camouflage practices which had publicly been seriously discussed. Responsible managements will probably endeavor such practices as they may appreciate that while during our present war emergency everything possible, the same atmosphere will not prevail forever. At the conclusion of hostilities, there may be the inevitable inequities of alleged excessive costs and charges of non-maintenance.

The Securities and Exchange Commission has announced that it has amended its regulations so that in effect military contracts need not be publicly disclosed. This action is very questionable and plays an important source of information. This measure also reveals the backwardness of numerous disclosures in relation to defense. But the most serious report to stockholders and others who had a legitimate interest in concerning the facts. There was no useful purpose in this policy as any discerning analyst could go to the SEC and have the complete work. A thorough study could reveal the important aspects of any company. The companies advanced by many company officials that to disclose certain information would be bad for competitive reasons or for other considerations, is absolutely fallacious and has brought more harm than good in the following table.

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TABLE I  
Market Action of  
Leading Aircraft Securities—1941

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Boeing	140	145	145	145	145	145	145	145	145	145	145	145
Consolidated	120	125	125	125	125	125	125	125	125	125	125	125
Lockheed	100	105	105	105	105	105	105	105	105	105	105	105
Martin	80	85	85	85	85	85	85	85	85	85	85	85
Boeing	140	145	145	145	145	145	145	145	145	145	145	145
Consolidated	120	125	125	125	125	125	125	125	125	125	125	125
Lockheed	100	105	105	105	105	105	105	105	105	105	105	105
Martin	80	85	85	85	85	85	85	85	85	85	85	85
Boeing	140	145	145	145	145	145	145	145	145	145	145	145
Consolidated	120	125	125	125	125	125	125	125	125	125	125	125
Lockheed	100	105	105	105	105	105	105	105	105	105	105	105
Martin	80	85	85	85	85	85	85	85	85	85	85	85

Notes: Figures in cents and not in dollars and not in cents. \* Figures in cents and not in dollars and not in cents. \* Figures in cents and not in dollars and not in cents.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Boeing	140	145	145	145	145	145	145	145	145	145	145	145
Consolidated	120	125	125	125	125	125	125	125	125	125	125	125
Lockheed	100	105	105	105	105	105	105	105	105	105	105	105
Martin	80	85	85	85	85	85	85	85	85	85	85	85

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## BONNEY TOOLS - Standard Equipment for Engines Made by Leading Manufacturers

MANY of the country's leading engine and engine manufacturing companies have selected Sonney Tools as the tool equipment to be shipped with their engines. They realize that only in these few tools can they obtain the same careful design, precision workmanship and fine finish that their product deserves.

In the Boway Line, an complete assortment of products with detachable handles, open end and bow wrenches open drive, phos, hammer, flat, flat, phos, etc., all in a wide variety of types and sizes to meet every conceivable need. In addition our wide experience in machine made and complete manufacturing facilities enable us to take care of any special all needs for special machines.

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Stocked by Leading Fishery Enterprises



Altschul

(Continued from page III)

The major conviction of the automobile industry towards the pooling of facilities for armament production has brought in its wake, an underlying trend which may leave its mark on the aircraft sector.

One of Weber's principal social ideas has been a greater if not equal voice in management. This has been based, prior to the war, on the theory that the working man contributes as much to the finished product as the capitalist, hence, the directing authority should be shared. At one time, such division of power appeared very remote. But, now, labor has been given as active voice as management in the processes of managing the enterprise. The autocratic industrialist, a pillar for labor on a just management viewed as a revolution in social control surpassing in importance the principle of collective bargaining upheld by the courts.

What has this all got to do with the aircraft industry? Simply this, A revolutionary development of this sort is rarely confined to one industry but becomes a national policy. Moreover, the automotive and aircraft groups are now related in more ways than one. Enlightened whose leadership may not only give them a greater appreciation of its responsibilities but may also

While air line operations broke badly during the war selling wars, only two items—Pope-Central and TWA—made new lows for the year, and the remainder failed to penetrate previous 1941 low marks. This was not surprising as air line equities grew ground easily during the suspension of 1940, making their lows, for the most part, at that time. Conditions prevailing at that time caused war action and the second half of 1941 saw a reversal of confidence in the

soundness of the industry. Moreover, the group has been among the first to know what restrictions are, hence is believed to have discovered many of the weaknesses of a war economy. Non-Central may have been unusually weak as it had to contend with the weight of new financing. TWA appears to be without the usual support of purchasers by the Hughes Tool Co. It has been some months since SEC releases show purchases by this party.

The air line equities, while experiencing a quick rebound, did not completely recover their earlier December declines. This may be recognition of

the fact that while the industry may maintain its independence, there will be definite limitations as to its political activities during this war period.

The current ship anticipates growing governmental priorities as space will become a major passenger between giving way at times whenever Army, Navy or defense personnel must utilize the situation to speed the war program. That is, nothing new to the operators as for more than a year they have been giving defense efforts and the armed services every consideration through priorities and other means.

Certain normal commercial business may be lost, but the air carriers will benefit by continued passenger traffic as a result of defense activity. Regularity of scheduled operations, however, may be subject to frequent emergency interruptions as a result of air raid warnings or plane diversions for military use.

These assumptions depend on transport revenues. Regardless of whether lights are maintained or not, the cable requires maintenance without any offsetting compensation. It remains to be seen whether the CAB will take measures to raise the higher costs of the operators resulting from new lights.

Previous trade and seasonal influences are without effect in projecting the costs of operations for the immediate future. Preliminary results for 1941, however, afford an opportunity to examine such changes up to this point.

The Hahnemann air fleet had gross revenues from all sources of about \$300,000 during 1941, or an increase of about 20 percent above 1940. Moreover, operating expenses, however, more than offset this increase and the industry's net income amounted but \$4,000,000, or about 13 percent below that earned by 1940. Moreover, during 1941 non-aircrafting income such as profits from the sale of planes was very seasonal while during 1940 more than 20 percent of the industry's net income came from such sources. Hence, the true earning power of the air carriers showed a serious impairment for 1941.

There was no uniform earnings trend in the industry. Three firms—American, Eastern and Northwestern—recorded new highs in net profits. This move thus offset the poorer showing of the smaller firms, a number of which experienced increased deficits for 1941. It must also be noted that the industry had in 1940 an aggregate deficit of \$1,180,000 for the first quarter of 1941. This reversed the group from incurring the year with a substantial increase in net income.

The figures show that United is still in the process of losing ground in the monumental field. For the ten

months in October 1941, Canada's gain in revenue passenger miles rose to only 30.2 percent above a year ago. As a result of constant American gains, 30.8 percent and TWA 26.5 percent. What this means is a continuing trend is shown by going back to 1939 when United recorded the 27.6 percent of the transcontinental passenger revenues, American 25.6 percent and TWA 24.4 percent. During 1940 these ratios became: American 31.5 percent, United 34.6 percent and TWA 23.6 percent. The year 1940 saw more of the same with both American and TWA closed-up, United.

There may be some significance in the appointment of an assistant to the president of United Air Lines in charge of stockholder relations. The function of this new office is "assessing inquiries, furnishing adequate information and in other ways maintaining proper contact with them (the stockholders)." \*

At a time, most stockholders are apathetic towards the affairs of their individual companies. It is needless to repeat that apathy in publicly-held enterprises is varied in its manifestations but characteristically are represented by a board of directors which in turn elects the officers to actively manage the affairs of the enterprise. In the case of United, a total of 1,500,000 shares of stock is widely distributed among some 25,000 stockholders. The directors, in the aggregate, have represented holdings of less than 20,000 shares or about one percent of the outstanding in the hands of the public. While some directors is a member of the banking firm that controlled 360,000 shares of United stock, it is not a simple case whereby one does not hold a single share directly or for any of its shares.

There may be one significant reason for this attitude by the stockholders by the United management. With blocks of stock registered in the names of brokers it may be difficult for the company to learn the identity of the real owners. At long as there are no controlling management shares, brokers may vote the shares in their name with the existing management. However, should any management be challenged, the broker must go to his client for voting instructions. Effective immediately, in this event, may be expected to become an important factor. This is not only because important to reach the truly own the stock but to reach the truly own will with "adequate information". Future developments will tell their own story and may bear witness.

Any air line company is a prize that can easily escape the attention of people web versus—and capital.





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**MALLORY**

F. B. NAUGHTON & CO., Inc.  
INDIANAPOLIS, INDIANA  
Circle 46 on Reader Service



**Specifications:** This airplane is made of aluminum alloy metal members constructed of which are made in Fig. 250. The models are provided with different engines as follows: 65 hp Continental 40 hp Franklin, 85 hp Franklin and 90 hp Franklin. Each engine is a single-cylinder, two-stroke type.

**Performance:** The speed of the 65 hp model is 161 mph, 800 ft/min for the 40 hp model and 230 mph for the 80 hp engine. Cruising speed is 90 mph for the 65 hp model and 140 for the 40 hp and 195 for the 80 hp model. Stalling speed is 77 or 85 mph. The engine-powered models have a range of 100 to 150 miles and the 40 hp model has a 100 mi. range and the 80 hp model 150 to 200 mi. range.

**ENVIRONMENT:** The females are of isolated short nesting. Nests are sparse and the sites are mixed. Eggs are singly or in pairs on the wings as well as on the footings. Landing gear is of basic type. Wheels are basic type 0.50 x 0 and bushes are known hydraulic type. The landing gear shock absorber is also basic. Brakes are emergency. Shock absorbers landing gear shock absorbers.

Brynnor Tennyson, *Headmaster Institute & Wel*

**Environment.** This model is processed by either an 85 hp Fordson or a 90-hp Fordson tractor. Both use .800-in. 20-110 C or S, overall length 23 ft, 4 in. and height overall 7 ft, 6 in. Wing area, including struts is 150 sq ft; the area of 60 sq ft, relative mass 8 sq ft, stabilizer 121 sq ft, and elevators (total) 5.5. Weight empty 190 lb; gross weight 1900 lb. Fuel capacity 25 gal; payload capacity 32 lb.

**Pharmaceuticals.** Three agents were given as a derivative of the benzotriazole order class.

**CONSTRUCTION:** Structural features follow the design of the Café, square horn and spiral ribs are used in the wings which are covered with fabric, as in the Gaudigo. Landing gear is fixed type, wheels are 20-in. type 500 x 2 and brakes are 20-in. hydraulic. Landing gear shock sets in oleo type.

These indicators, (i) 8 days interventions—closed culture, (ii) emergency care, (iii) private care



**Specifications:** The Kumpas Crusader is a two-cylinder type powered by a 75 hp. Cummins diesel engine, including alternator, 180 sq. ft., cylinder 17.4 in. dia 5 in. stroke, 1000 rpm; stabilizer 13.5 in. dia. and total deck area 11.25 sq. ft. Dry weight 800 lb., gross weight 1,650 lb. Piling loading 750 lb. per sq. ft., power loading 30-5 lb. per sq. ft.

**PERFORMANCE:** Shift speed 122 m.p.h. at 2,000 ft.; landing speed 102 m.p.h. at 2,000 ft.; landing speed 58 m.p.h. climb at sea level 600 ft. min. Service ceiling 10,000 ft. Normal range 500 mi.

**CORROSION:** Fuselage is a welded steel tube structure with fabric covering; wings have solid upper skins with corrugated ribs and fabric covering.

Deployment instruments include skimmer, six speed indicator, oil thermometer, pump, fuel meter.

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**DESCRIPTION:** Locomobile manufacturing Co. models with different engines: 65 or 75 hp. Over 1000, 55 hp. Locomobile. The Locomobile engine is described in the section that follows this one. Model 842 has a 52 hp. Continental engine. Wing loading is 54 lb. per sq. ft. and power loading is 18.5 lb. per hp. Weight empty is 820 lb. and gross weight is 1,200 lb.

**Performance:** High speed is 128 m.p.h. Cruising speed is 104 m.p.h. Stalling speed is 27 m.p.h. Service ceiling is 32,000 ft. Normal range is 300 miles.

**CONTRACTORS:** The furniture is made of aluminum alloy ball-bearing and aluminum alloy wheels. Wing seats are dual 24-inch and ribs are dual.

**STANDARD EQUIPMENT:** Model SA-2 has its following standard equipment: Instruments include an altimeter, oil temperature and pressure gauges, a tachometer, oil pressure indicator, and a compass. Fuel filler is a Remondak, the control seat which is made by Hark, brakes are by Gates, the wheels are



## INTERSTATE CASES

chain indicator, a U. S. Gage wet-wound indicator, an oil temperature indicator, an oil pressure gage, an oil cooler, and an Remyco compressor. Accessories include: Tereosol dye, Nitro brushes, U. S. propellers, and Gageco tubes.



INTERSTATE 21A 800 800

and adjacent, *Allylph* complex. Acoustical isolates  
REI and REI-T mode. See specifications on page  
80.



CHAPTER 24: CRUSADER

all previous page size models. Day 100000 and 200000. The Kasper Cruiser has similar two spin models, the KAC-1 and KAC-2, which are exactly the same. Specifications for all three given on table, page 20.



LUDOMIN MODEL 842

It ends by Yushita, and there is a rather brutal, twin-motifed, a Hummer overhauled snort, two sub large two glove compartments, and two map pockets in the door. For further specifications see June 200



MERCURY ST-10 TRAINER

**DESCRIPTION:** This is a two-place tandem biplane which is made in two models. One model has a 100 hp. Kinner engine and the other a 120 hp. Franklin engine. Weight empty of the 100 hp. model is 1012 lb. and gross weight is 1500 lb. The



MONOCOUPÉ DESIKRE MODEL 9-AF

**DESCRIPTION:** This is a two-place side-by-side biplane covered with a 30 ft. Franklin engine. Wing span is 32 ft. Length overall 29 ft. 6 in. Weight is 2 to 3 lb. The wing area is about 117 sq. ft. Wing loading is 112.2 lb. per sq. ft.



MORAY VICTORY TRAINER

**DESCRIPTION:** This is a two-place tandem trainer powered by a 115 hp. Lycoming engine. Wing span is 30 ft. 6 in., length overall is 25 ft. 7 in., and the height is 7 ft. 9 in. The wing area is 140 sq. ft. Wing loading is 30.6 lb. per sq. ft. and power



MORTON MODEL 16-B

**DESCRIPTION:** This is a two-place side-by-side biplane powered with a 100 hp. Franklin engine. Wing span is 30 ft. Length overall is 19 ft. 6 in. and the height is 7 ft. 9 in. Wing loading is 37.6 lb. per sq. ft. and power loading is 22.5 lb. per hp. Weight

120 hp. model has a weight empty of 1250 lb. and a gross weight of 1800 lb.

**PERFORMANCE:** High speed of the 100 hp. model is 164 m.p.h. and a cruising speed of 84 m.p.h. and a stalling speed of 40 m.p.h. It climbs at 500 ft. per min. and has a service ceiling of 20,000 ft. The 120 hp. model has a high speed of 182 m.p.h., cruise at 97 m.p.h., stalls at 50 m.p.h. and climbs 543 ft. per min. Service ceiling is 21,000 ft. Fuel capacity of each model is 20 gal. and reserve range is 250 mi.

**CONSTRUCTION:** The fuselage is made of solid steel tubing and is fabric covered. Ribs are of spruce and ribs are of aluminum alloy. Wings are fabric-covered. The landing gear is of fixed type and the wheels have a tread of 16 ft.

**FEATURES:** Equipment includes an oil filter, tachometer, oil pressure gauge, fuel pressure gauge, oil thermometer, air speed indicator, landing switch, fuel selector, pump, altitude control and a carburetor heat control. These items are duplicated in both models. For further specifications see page 202.

and power loading is 17.5 lb. per hp. Weight empty is 1200 lb. and gross weight is 1550 lb.

**PERFORMANCE:** The airplane has a top speed of 120 m.p.h. at sea level, a cruising speed of 80 m.p.h. and a stalling speed of 40 m.p.h. It climbs at 500 ft. per min. and has a service ceiling of 14,000 ft. Fuel capacity is 20 gal. which gives the ship a normal range of 200 mi. Fuel consumption at cruising speed is 5.5 g.p.h.

**CONSTRUCTION:** The fuselage is made of solid steel tubing and is fabric-covered. Ribs are of solid spruce and ribs are of wood. Wings are fabric-covered. The landing gear is of fixed type and the wheels are 22 in. diameter aircraft wheels and Goodrich tires. The landing gear has a shock cord unit. Tail unit is a wheel. For further specifications see table on page 202.

loading is 13.45 lb. per sq. ft. Weight empty is 1,750 lb. and gross weight is 2250 lb.

**PERFORMANCE:** High speed of this trainer is 145 m.p.h. at sea level and its cruising speed is 143 m.p.h. Stalling speed is 32 m.p.h. The ship climbs 500 ft. per min. at sea level and has a service ceiling of 15,000 ft.

**CONSTRUCTION:** Both fuselage and wings are of pipe, steel construction and are fabric-covered. Ribs are spruce, but-type and ribs are also of wood. The landing gear is retractable and has a tread of 16 ft. 6 in. Wheel size is 30 in. 6 in. Between wing spar and the landing shock unit is the air and oil type. This airplane is in production and has received a great deal of attention because of the use of wood construction. For further specifications see page 202.

empty is 170 lb. and gross weight is 2225 pounds.

**PERFORMANCE:** The airplane has a high speed of 150 m.p.h., a cruising speed of 150 m.p.h. and a stalling speed of 50 m.p.h. Fuel capacity is 20 gal. and the normal range is 300 mi. Fuel consumption is 5.85 g.p.h.

**CONSTRUCTION:** The fuselage is of solid steel tubing and is fabric-covered. Ribs are of spruce and ribs are of aluminum alloy. Wings are fabric-covered. The landing gear is of standard type and wheels are 30 in. 6 in. Franklin type and Empire tires. The landing shock unit is winged shock unit. The airplane has a special powered control system. All material specified was made available in full lengths. It was pointed out that an "A-141" would be produced early in 1932. For further specifications see page 202.



MONOCOUPÉ 10-AF BLITZER



AEROBEE 14



AEROBEE 16



AEROBEE 18

## Greater Capacity for Aircraft Tubing -to help smash production bottlenecks

To help speed aircraft production schedules, part of the tremendous facilities of Steel and Tube Division, Republic Steel Corporation—world's largest producer of electrically welded tubing—is being devoted to the manufacture of Republic ELECTRUNITE Aircraft Tubing. Thus, more and more tubing is now available to help smash production bottlenecks in airplane fabrication.

Republic ELECTRUNITE Aircraft Tubing—made by the same proven process employed in the production of millions of feet of carbon and stainless steel tubing for pressure, mechanical, structural and electrical applications—affords all the advantages of electric resistance welding. It is consistently uniform in diameter, wall thickness, concentricity, strength, weight, ductility, hardness, weldability and smooth, scale-free surface.

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Republic ELECTRUNITE Aircraft Tubing meets specification standards of the U. S. Army Air Corps, Bureau of Aeronautics, Navy Department, and the Civil Aeronautics Administration.

Present size range is from 1/2" O.D. up to and including 4 1/2" O.D. with a gauge range from .030" up to and including .065" in S.A.E. X-4130 steel.

ELECTRUNITE Stainless Steel Tubing—made of Republic ENDURO®—is also available in standard analysis—size range from 1/2" O.D. to 3" O.D.—with gauges ranging from .025" up to and including 11 gauges—conforming to Government Specifications for each material.

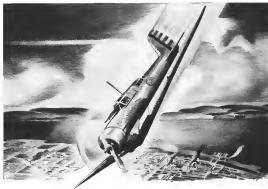
Write for complete detailed information and test reports. Steel and Tube Division, Republic Steel Corporation, Cleveland, Ohio.

\*See E. S. Fig. 68.



# Republic ELECTRUNITE

ELECTRIC RESISTANCE WELDED TUBING



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flexibility of our organization, plus the services of our famous engineering laboratories. For the aircraft customer Auto-Lite is equipped to produce:

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# AUTO-LITE

SPARK PLUGS • STARTING  
LIGHTING • IGNITION  
BATTERIES • WIRE & CABLE



**DESCRIPTION:** The J3 trainer is made in three different models differing in dual Continental, Franklin or Lycoming engines and the J-3. This is a description of the Continental model. Wing area is 30 ft. 5/8 in. Span 34 ft. 0 in. Length 27 ft. 0 in. and the height is 6 ft. 0 in. Empty weight is 1750 lb. Gross weight is 2000 lb. Empty fuel is 12 ft. 0 in. Fuel capacity is 40 gal. and cruise speed is 1100 ft. Performance: High speed with this engine is 60 m.p.h. at sea level and cruising speed is 50 m.p.h. Stall speed is 38 m.p.h. and the climb rate is 900 ft. per min. with a 300 ft. climb rate in 1200 ft. Fuel capacity is 40 gal.

**DESCRIPTION:** This landing is made of metal and tubing which is fabric-covered. Wing spars are of solid spruce and ribs are of aluminum alloy. Wings are fabric-covered. Landing gear is of steel pipe, in fixed or retractable. Wheels are Dage type 308 x 4. Engines are made by Lycoming.



Two landing gear versions. The Supertrainer has a 1000 lb. Lycoming engine and the J-3. Cruise rate is 10 ft. per min. Gross weight is 2000 lb. Performance: High speed with this engine is 60 m.p.h. at sea level and cruising speed is 50 m.p.h. Stall speed is 38 m.p.h. and the climb rate is 900 ft. per min. with a 300 ft. climb rate in 1200 ft. Fuel capacity is 40 gal.

**DESCRIPTION:** Landing gear is of the same construction type as the J-3 trainer described above. Standard equipment. The engine has of impeller and belt pumps, an alternator, a battery,



**DESCRIPTION:** Two landing gear models in the same design. The difference being in the engine. Model 190 is powered with an 80 hp. Continental engine. Model 190T has an 80 hp. Franklin engine and Model 190T has a 90 hp. Franklin engine. Empty weight is from 2200 to 2350 lb. Gross weight is from 2400 to 2550 lb. depending upon the engine.

**DESCRIPTION:** High speed of the 190 model and of the 190T model with above the 80 hp. Continental or Franklin is 110 m.p.h. cruising speed is 100 m.p.h. Stall speed is 38 m.p.h. and the climb rate is 900 ft. per min. with a 300 ft. climb rate in 1200 ft. Fuel capacity is 40 gal.

**DESCRIPTION:** Landing gear is of the same construction type as the J-3 trainer described above. Standard equipment. The engine has of impeller and belt pumps, an alternator, a battery,



**DESCRIPTION:** High speed 140 m.p.h. at sea level of 900 ft. cruising speed 110 m.p.h. at sea level of 900 ft. Stall speed 38 m.p.h. and the climb rate is 900 ft. per min. with a 300 ft. climb rate in 1200 ft. Fuel capacity is 40 gal.

**DESCRIPTION:** Landing gear is of the same construction type as the J-3 trainer described above. Standard equipment. The engine has of impeller and belt pumps, an alternator, a battery,



THE PIPER J3 TRAINER

Standard equipment. Included in standard outfit, seats are the following: 10 ft. of impeller and pressure gear, an alternator, a battery, an alternator and a battery. For further specifications, see page 20.



PIPER MODEL J3 CRUISER

and closed ballast with a ballast. Two 10 ft. seats by Dage. Landing gear is of the same construction type as the J-3 trainer described above. Standard equipment. For further specifications, see page 20.



BEECHCRAFT MODELS 190 AND 190T

The landing gear shock strut is a ballast and the tail is a wheel. Standard equipment. Included in standard outfit, seats are the following: 10 ft. of impeller and pressure gear, an alternator, a battery, an alternator and a battery. For further specifications, see page 20.



BEECHCRAFT Model 190-415

Standard equipment. This model includes the following: 10 ft. of impeller and pressure gear, an alternator, a battery, an alternator and a battery. For further specifications, see page 20.



# For Arc Welding All Thin-gage Metal

## The NEW Strikeeasy

The STRIKEEASY arc welder is specially designed for easy maintenance. It has a built-in control unit which permits welding of spot sizes up to 1/2 inch in diameter. It has a built-in control unit which permits welding of spot sizes up to 1/2 inch in diameter. It has a built-in control unit which permits welding of spot sizes up to 1/2 inch in diameter.

### LOOK AT THESE FEATURES!

**INSTANT RECOVERY VOLTAGE** high enough to make the arc strike every time, even on light-gage sheet having a polished surface. This feature helps prevent keep the tip going with the low heat required for successful welding of thin materials and makes an amazing number of welds by making the arc strike easily. Set time and easy control.

**LIMITED CURRENT RANGE**—even exceeding three times easily adjustable range can meet all spot welding. This provides rapid reaction, extra efficiency and helps avoid burn through.

**100% TAP ACROBAT ADJUSTMENT** of welding current is possible by means of a one-point tap switch (the "tap") and a built-in control (the "control").

**SELF PROTECTING** is provided by the welder's built-in control design which automatically adjusts current to prevent overheating and avoids maintenance of an extra governing unit.

**PERFORMING PROBLEM**—welding units are designed to weld even the most difficult materials. They are designed to weld even the most difficult materials. They are designed to weld even the most difficult materials.

**MINUTE REPAIRS**—provide easy access and change in hours and minutes.

**SELF-HEATING RAIL REPAIRS**—EXTRA VENTILATION—EXTRA BALANCE—



ARC welding thin gage metal having a clean, bright surface requires a welder with extra refinements and extra performance.

For example, actually welding requires an arc that strikes the first time, and every time. If the arc fails to strike, the joint is likely to be ruined, and valuable time and production may be lost. Another important item is precise current adjustment. Weld-quality depends on a good control, on the amount of current used. One or two amperes more than needed may cause burn-through, one or two amperes less than needed may result in pile-up of the weld metal.

The STRIKEEASY arc welder, an actively new product has been developed to meet these exacting demands. It always permits the operator to strike the arc every time—minus at the lowest level. Current is easily and accurately adjusted to meet up requirement. Full details in Bulletin GEA-3726. Please or write for a copy today!



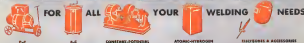
General Electric and its employees are proud of the many awards of excellence made in the Electric Works for the achievement of great products.

# Aircraft Arc Welder



**WHY IT STRIKES THE ARC EASILY**—Experience and research show that in order to provide easy striking of the arc on thin gage metal, such as aircraft welding, the voltage produced by the welder must, regardless of open circuit voltage, recover instantly after short circuit to a value at least as high as the arc voltage. To provide an extra margin of satisfactory performance, the STRIKEEASY is designed to produce 40 to 60 volts instantly after short circuit. (Oscillographic measurements show that actually 40 to 60 volts are obtained.)

**ELIMINATION OF WELD CRATER**—can be accomplished by either lengthening the arc or by reducing welding current by means of a control device, such as the G.E. CRATER-FILLER, which is specifically designed for operating with the STRIKEEASY. The Crater Filler is a portable, fast-operated, quick-acting, heat control device. Control by a push button on the electrode holder is also obtainable by means of a "Brace" Crater Eliminator designed particularly for the Strikeeasy. General Electric Company, Schenectady, New York.



## GENERAL ELECTRIC





## CIVIL AIRCRAFT 4 TO 5 SEATS



BEECH BIPLANE MODEL D-1E

**DESCRIPTION:** This is a single-engine biplane powered with a 400-hp Pratt & Whitney engine. Wing span is 32 ft. Length is 23 ft. Weight is 3,600 lb. Stated cruise speed is 200 m.p.h. Wing loading is 14.07 lb. per sq. ft. Power loading



CESSNA MODEL T-40 TWIN

**DESCRIPTION:** Span 41 ft. 11 in., overall length 32 ft. 9 in., height overall 8 ft. 12 in., landing gear fixed 121 in., wheel loading 17.5 lb. per sq. ft., power loading 17.0 lb. per sq. ft., 3,000-hp weight empty 5,000 lb., gross weight 6,000 lb. It is powered by a 2-cylinder engine with a



MARCH MODEL F-31 (W-41)

**DESCRIPTION:** Span 35 ft. 6 in., overall length 35 ft. 0 in., height overall 8 ft.; landing gear fixed 121 in., wheel loading 17.5 lb. per sq. ft., power loading 17.5 lb. per sq. ft., 1,400-hp weight empty 2,200 lb., gross weight 3,600 lb. It is powered by a Warner 245-hp



LANGLEY D-4

**DESCRIPTION:** Span 35 ft. 0 in., length 30 ft. 6 in., height 7 ft. 1 in., landing gear fixed 100 ft. 0 in., overall weight is 2,800 lb. and weight empty 1,000 lb. It is powered by two 100-hp Franklin standard engines. **PERFORMANCE:** Top speed is 140 m.p.h., cruising

speed 120 m.p.h. per hp. Max. cruise in 2,000 ft. turns circle in 4,500 ft. **PERFORMANCE:** High speed of this biplane is 111 m.p.h. at sea level. Cruise speed is 202 m.p.h. at 10,000 ft. Cruising speed is 30 m.p.h. The airplane will climb 1,500 ft. per min. at sea level. Rate of descent is 15,000 ft. per min. Fuel consumption at cruising speed is 22 g.p.h.

**CONSTRUCTION:** The fuselage is of welded steel tubing covered with fabric. Spars are of solid spruce and ribs are also of spruce. The wing is fabric-covered. The landing gear is retractable. The fuel tank is 50 ft. in diameter. 7.500-lb. fuel tank. The landing gear shock absorber is of spring steel shock absorber. The tail wheel is retractable. For further specifications on this model see table on page 205.

rate of 400 ft. at sea level, fuel capacity 120 gallons, normal cruise 120 m.p.h. Fuel consumption at cruising speed 20 g.p.h. per hour (cruise) of 10,000 ft. wing area (including spars) 270 sq. ft., total disc area 19 sq. ft., total disc area 217 sq. ft., total disc area 217 sq. ft. Rate of

**PERFORMANCE:** High speed 180 m.p.h. at sea level, cruising speed 250 m.p.h. at an altitude of 10,000 ft., landing speed 50 m.p.h. climb at sea level 1,500 ft. per min., cruise circle 10,000 ft. **CONSTRUCTION MATERIALS:** Wing spars are of bent solid spruce, spars ribs, tubes and aluminum alloy covering material. Landing gear is of welded steel tubing. Landing gear shock absorber landing gear shock absorber. The landing gear is retractable type wheel area 5.00 x 20. Landing gear shock absorber. Rate of descent 15,000 ft. per min. wheel shock absorber. For further specifications see table p. 205.

engine at sea level. Fuel capacity 120 gallons, normal cruise 120 m.p.h. Fuel consumption at cruising speed 20 g.p.h. per hour (cruise) of 10,000 ft. wing area (including spars) 180 sq. ft., total disc area 19 sq. ft., total disc area 217 sq. ft., total disc area 217 sq. ft. Rate of

**PERFORMANCE:** High speed 180 m.p.h. at sea level, cruising speed 250 m.p.h. at an altitude of 10,000 ft., landing speed 50 m.p.h. climb at sea level 1,500 ft. per min., cruise circle 10,000 ft. **CONSTRUCTION MATERIALS:** Spars of solid spruce, spars ribs, tubes covering material, fuselage is of welded steel tubing with fabric covering.

**PERFORMANCE:** High speed 180 m.p.h. at sea level, cruising speed 250 m.p.h. at an altitude of 10,000 ft., landing speed 50 m.p.h. climb at sea level 1,500 ft. per min., cruise circle 10,000 ft. **CONSTRUCTION MATERIALS:** Spars of solid spruce, spars ribs, tubes covering material, fuselage is of welded steel tubing with fabric covering. The landing gear is of bent solid spruce, spars ribs, tubes and aluminum alloy covering material. Landing gear is of welded steel tubing. Landing gear shock absorber landing gear shock absorber. The landing gear is retractable type wheel area 5.00 x 20. Landing gear shock absorber. Rate of descent 15,000 ft. per min. wheel shock absorber. For further specifications see table p. 205.

speed 120 m.p.h., rate of climb with full fuel 600 ft. per min., and service ceiling is 20,000 ft. Landing speed is 40 m.p.h. and the cruise is 500 miles with a fuel consumption of 5 gal. per hr.

**CONSTRUCTION:** The main parts of the Langley are made by the use of heavy formed steel and are generally bolted together. Bulk of the largest members are joined without any mechanical fasteners, work in steel bolts or rivets. The principal work is aluminum tubing and steel structural parts which are bolted together on a steel plate in a specially constructed tubular bag from which all the air is exhausted. The part is then covered with a layer of steel on one side. The wing is of composite

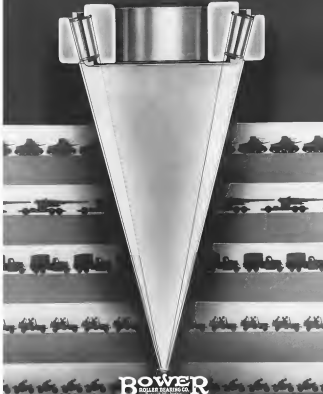


LANGLEY D-4 REAR VIEW



construction and follows conventional design; the spar is in 2 beam of bent-up laminations of spruce. Ribs spars and ribs are welded together into one piece of steel on one side. Landing gear is of bent steel. For specifications, page 205.

# KEEP 'EM ROLLING













CURTIS C-46 CARGO TRANSPORT

The C-46 is Curtiss-Wright's answer also to the heavy transport field. During the history of the large type of transport, Curtiss has built many of the best type of transport, such as the B-24 bomber, but probably the most famous of these was the C-46.



CURTIS C-52 OBSERVATION

The Curtiss C-52 is a twin-engine observation aircraft with a high-wing configuration. The plane is equipped with a pilot and an observer and is used for the long range, such as the model which carries



CURTIS HAWK B-24

The Curtiss Hawk B-24, known as the Hawk, is the most modern of the B-24's. It has no predecessor in the line of the Hawk series.



CURTIS HAWK P-40 FIGHTER

The Curtiss Hawk P-40 has no predecessor in the line of the Hawk series. It has no predecessor in the line of the Hawk series. It has no predecessor in the line of the Hawk series.

Today the world's largest single engine transport, designed by the Curtiss-Wright Corp. and built at Buffalo, N.Y., is the Curtiss C-46.

**PERFORMANCE.** The Curtiss C-46, powered by two Pratt & Whitney double-row engine units which 1,600 (total) hp, is now ready to fly at 20,000 ft. It has a cruising speed of 140 mph and a top speed of 160 mph. It is expected that this transport will maintain a top speed of 160 mph.

**CONSTRUCTION.** The Curtiss C-46 is a low-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.

the use of fully metal construction.

**PERFORMANCE.** The Curtiss C-52 is a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.

**CONSTRUCTION.** The Curtiss C-52 is a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.

which is powered with an Allison "V" type liquid cooled engine and equipped with Curtiss radial speed controlled propellers.

**CONSTRUCTION.** The Curtiss Hawk B-24 is a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.

**PERFORMANCE.** The Curtiss Hawk B-24 is a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.

The Hawk P-40 is a single seat low wing monoplane capable of carrying out the most exacting of aerial maneuvers.

**PERFORMANCE.** No figures are released as yet, but the Curtiss Hawk P-40 is expected to be the most powerful of the P-40's. It is expected to be the most powerful of the P-40's.

**CONSTRUCTION.** The Curtiss Hawk P-40 is a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure. It has a high-wing, all-metal, semi-monocoque structure.



## WHO WILL BE THE KEY MEN OF TOMORROW IN AVIATION?

The first few weeks of war made clear to all the fact that America's future lies in aviation. Planes and more planes are the need of the hour. The United States, most fortunately, can and soon will overcome all its enemies in the production of fighting aircraft. That fact alone is a guarantee that our young men in aviation today will profit by and honor this example. Thousands are prepared, thousands more are preparing—thoroughly and resolutely—to make American aviation the most powerful force in the world for victory—and later peace.

### The Future of Aviation

You who begin your aviation today with the primary thought of serving your country will also be the future for peace will surely bring an improved development of commercial flying, especially in the future. The war, which has been equipped to serve—its war and peace—will be the key men of tomorrow in aviation. Our schools might perhaps have been such.

G. S. Jones  
President

ACADEMY OF AERONAUTICS, LaGuardia Field, New York  
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Olaton, Okla., March 11  
Aerial view of call for America and World affairs.



# This is why ONSRUD SETS A NEW PACE IN AIRCRAFT PRODUCTION



One of the Onsrud Machet Arm Routers at work on aircraft wing skins, fuselages, and control fins.

## LUBRICATED BY



Oil misters are better suited to defense for manufacturing through process production shops. Proper installation of metered misting devices, plus properly used oil measuring capabilities perfect feeding lubrication in the form of fine size particles. Onsrud patent Metered Mist Lubrication has proved itself at speeds up to 1,000 to 10,000 RPM through millions of machine hours of operation.

Spinning smoothly at 15,000 RPM, the router bit of the Onsrud Machet Arm Router cuts in one pass as much as 25 cracked sheets of .015 dual at 10 feet per minute straight level.

At such super cutting speeds, spindle bearings cannot stand up unless lubrication is perfect. Too much oil is as great a danger as too little. Metered Mist achieves the miracle of perfect lubrication at high RPM . . . measures out oil particles as tiny as mist, exactly as fast as required.

For the accurate machining of non-ferrous metals, remember Onsrud tools and machines with Metered Mist to do the job faster, easier, and for far less cost.

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AIR TURBINE and HIGH CYCLE

MACHINERY and TOOLS

ROUTING • DRILLING • SHAPING • GRINDING • MILLING



This Navy model trainer is used for first, high altitude training for pilots directly before their transfer to fighting aircraft. It is a two-seater, full speed-over-sound of all metal construction, and resembles the Curtiss 21 interceptor as outline. It is powered with a radial engine and is equipped with retractable landing gear which folds back into a "standard" four landing mainline in Curtiss design. The two-



This is an advanced trainer powered by two radial engines which is designed for dive experience in the multi-engine type. An all metal, low wing monoplane, it is equipped with retractable landing gear of the conventional type and has accommodations for the side-by-side seats. It is said that its flight



Powered with a 12-cylinder Whitehead radial engine, the Curtiss Falcon is of the same design as the Navy Curtiss 12A trainer described in the top of this page. It is a two-seater, full speed-over-sound of all metal construction, with retractable landing gear. In the photo showing the plane, the "standard" type



**DESCRIPTION:** Adapted to dive as a dive bomber or scout, the A-1N is a two-place monoplane powered by a Wright Cyclone delivering 600 hp. at 2,000 ft. Speed is 40 ft., 5 m., height 31 ft., 4 m., and length 34 ft., 1 in. Wing area, including ailerons, is 288.6 sq. ft., 12.22 ft. radius 1.52 ft., chord 16.1 ft. ft., tail diameter 10 ft. ft., track width (base) 17.70 ft. (locally) 8.81 ft., other figures are estimated.

**PERFORMANCE:** Only the stalling speed, 121 m.p.h., and climb at sea level, 1,000 ft. per minute, are known.

**CONSTRUCTION:** Fuselage is riveted aluminum alloy



CURTIS 24C-1 TRAINER

type is of all metal construction as is the full engine version. No extensive measuring performance and speed tests, or the speed of the Navy, when the model first was introduced have been recorded.



CURTIS 24A TRAINER

having the plane was flown at many times within a few weeks in a wide variety of maneuvers under various engine conditions in a full range of altitudes. performance, speed tests, and other details have been recorded.



CURTIS FALCON 22E

being into which the landing retractors built into the wing are observed. The tail wheel is a fixed type. As in the previous Curtiss airplanes, no performance, landing, speed tests, or other data are released for publication.



DOUGLAS A-1N DIVE BOMBER

with dual retracting. Wings are aluminum alloy, square ribs and covering. Landing gear is retractable with fixed tail wheel. A fixed tail fin. Engines are hydro-mechanical and have gear drive to the propeller shafts.



2008年12月 第10期

This is the largest theatre in the world. It is an important type now undergoing complete testing by the Air Corps. Although it has a crew of ten, it could be fired off a troop transport capable of carrying 100 soldiers.



DIGITAL DELINQUENCY

The Bowyer is being used by the B.A.F. in the Balkan countries and has done very effective service in shooting down enemy aircraft. It is similar to the A-20B which is used by our air forces in my critical bomber. A nightfighter version is the flame.



DOUGLAS C-47 CARGO TRANSPORT

**RECOMMENDATIONS:** This is a certified DC-2 model adopted for Army use. It is powered by two Franklin D. Minnery two-cylinder engines delivering 21000 hp at 7300 ft. Speed is 60 ft. length overall 64 ft. 8 in. height overall 10 ft. 11 in. Gross weight, loaded



STANDARD COSTS

There is a two-phase model used by the Navy as a Range or Data Recorder and is powered by a Wright Cyclone rated at 150 hp. or 5,000 ft.

**Specifications:** Span 40 ft. 0 in. Length overall 22 ft. 8 in. and height overall 10 ft. 6 in. Wheel over



Power: 5017 hp @ 33, and direction 4104 sq ft.

Performance: Landing speed 76 mph, and climb at sea level 540 ft per minute.



NOV 20 1964



**Comments:** Spars, ribs, and covering material are added. Landing gear is reasonably typical type with a trend of 420 in. wheel and 50 in. in diameter landing hydraulic. Landing gear shock used is the Oleo pneumatic type. Specifications on table page 207.

**Development.**—Powered by two Wright dual-cowbush engines rated at 2,700 hp at 5,000 ft, it has a cruise speed of 20,000 ft and a weight of 12,000 lb. Span is 61 ft 4 in. Wings covered 45 ft and height covered 21 ft 7 in. Wing area includes ailerons. It has 48 in. of clearance 41 ft, 11 in. 28 in. ft, roller 25.3 in. ft, and endboard 62.5 in. ft clearance 43 in. ft. Wing loading is 41.6 lb per sq ft and power loading is 22.3 lb per hp.

**Performance.**—This Agusta is mostly suitable for the transport of troops, and it can also carry 200 troops, 30 in. p.h., and climb at an average 2,000 ft/min.

[illegible]

**Performance:** Top speed and cruising speed 6 knots are maintained by trailing speed in 30 m pH.

**CONSTRUCTION:** Passage structure is elevated 4' and built with Alkaloid concrete; apron, ribs, and concrete masonry blocks. Landing gear is symmetrical, aluminum, 4x15"–16". Hydraulic brakes and Otto pneumatic landing gear shock and are installed. Speed indicator on nose gear.

Including slats is 228.8 sq. ft. Slats 28.4 sq. ft., 12 in. 12.5 in. ft., rubber 19.2 sq. ft., cables 72.1 sq. ft., and elevators 18.6 sq. ft. Gross wing is 7,640 lb., weight empty 5,575 lb. Wing loads 25.8 lb./sq. ft., power loading 8.20 hp./sq. ft. Fuel capacity 228 gal.

**COMMENTS:** Only the trailing sprout, 72.5 mpt and almost at sea level, 1,020 ft. lvs. are revealed.

A NEW GIANT OF THE AIR... *for War or Peace*



1980) it is more likely that more  
 than 400 yr will be required to  
 grow to the size of the largest  
 trees in the forest.

**NEW**—Lorraine, B.J. Carolina Southern has the U.S. Army's Greatest Weight Lifting Athlete of the Year. He is the

1999—Customs Confing. 2 ppts.  
at 1:30 p.m. weekly, 1999, at 1  
hills road, and 1999 to 1:30 p.m.

deeper plants — 6 samples  
 100 ft. each with 2 layers, in  
 100 ft. — Weight 100 lbs. or

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the Survivors 44 page

"From Wages" (Dances  
de la Courant) (Sally, in  
Habit) or with other

...and I don't know how to  
...and I don't know how to  
...and I don't know how to

● The large expansion of Air Berlin was not yet on the horizon when Carsten Wipper began the development of this new and lighter aircraft, the largest business transport in the world. That its greater speed, its extra cargo and passenger capacity, and its inherent safety, were all accomplished in a twin-engine design is an additional testament to the

Currently an impressive number of these giant ships are in production to serve the United States Army to cargo and troop transports. But the time is not far distant when they will fly you over the nation's commercial routes with the utmost in comfort and beauty.

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Corporation  
AIRPLANE DIVISION

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# MILITARY



MARTIN PBM-1 MARINER

The Martin flying boat Model 166 or PBM-1, has been destroyed by the Navy. The Mariner 1 is a transport for long range patrol duties and has a gun turret in the nose and another when the landing hull is out of the water. The nose floats retract in 10 seconds.



NORTH AMERICAN AT-6A ADVANCE TRAINER

One of the standard trainers used by the advanced students, the AT-6A is being replaced by the AT-6B Air Corps in large numbers. Reids two in tandem. Performance: Powered by a Pratt & Whitney Wasp, rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal.



NORTH AMERICAN HARVARD

This type, in service with B.O.A.P. and B.A.F. is the most in the AT-6A in service with the U.S. Army Air Corps and Navy. Performance: Powered by a Pratt & Whitney Wasp rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal.



NORTH AMERICAN NA-22 SCOUT TRAINER

This type, which is in production for the United States Army, is similar to the AT-6A in service with the United States Army Corps and Harvard trainer, used by the British. Performance: Powered by a Pratt & Whitney

Wasp, rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal. Performance: Powered by a Pratt & Whitney Wasp, rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal.

111 gal. fuel consumption at cruising speed 205 gal/hr. Propeller diameter 106 in. Weight, 4,700 lb. empty, gross weight is 5,240 lb. Wing area, 16.5 sq. ft. Cruise speed 150 mph at 5,000 ft. Stall speed 50 mph at 5,000 ft. Rate of climb at sea level 1,500 ft./min. Service ceiling 20,000 ft. Speed range 150 mph.

Construction: Fuselage is a solid stressed-skin design and wing structure from forward to rear section, therefore monocoque type. Tail unit is a conventional monocoque type with fixed surfaces of aluminum alloy and movable surfaces of fabric-covered. Landing gear retractable, fully automatically operated. Tail wheel retractable. One or two 30 caliber guns may be installed in fuselage and one 30 caliber gun in rear cockpit. For further specifications see page 26.

In 111 gal. fuel consumption at cruising speed 205 gal/hr. Wing area (including streamer) 16.5 sq. ft. Cruise speed 150 mph at 5,000 ft. Stall speed 50 mph at 5,000 ft. Rate of climb at sea level 1,500 ft./min. Service ceiling 20,000 ft. Speed range 150 mph.

Construction: Fuselage is a solid stressed-skin design and wing structure from forward to rear section, therefore monocoque type. Tail unit is a conventional monocoque type with fixed surfaces of aluminum alloy and movable surfaces of fabric-covered. Landing gear retractable, fully automatically operated. Tail wheel retractable. One or two 30 caliber guns may be installed in fuselage and one 30 caliber gun in rear cockpit. For further specifications see page 26.

Wing rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal. Performance: Powered by a Pratt & Whitney Wasp, rated at 100 hp at 5,000 ft. Fuel capacity is 100 gal.

Construction: Fuselage is a solid stressed-skin design and wing structure from forward to rear section, therefore monocoque type. Tail unit is a conventional monocoque type with fixed surfaces of aluminum alloy and movable surfaces of fabric-covered. Landing gear retractable, fully automatically operated. Tail wheel retractable. One or two 30 caliber guns may be installed in fuselage and one 30 caliber gun in rear cockpit. For further specifications see page 26.

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NORTH AMERICAN AT-6A



NORTH AMERICAN AT-6A



NORTH AMERICAN AT-6A



NORTH AMERICAN HARVARD



NORTH AMERICAN HARVARD



NORTH AMERICAN HARVARD



NORTH AMERICAN HARVARD



NORTH AMERICAN HARVARD

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REPUBLIC P-44 THUNDERBOLT

Before the last invasion of Norway in 1940 more than 40 of this type were delivered to Sweden. An interesting feature is the special fuel tank which is fused to the wing itself. Armament of 6.5 mm. locally the P-44 (see Aviation, 14th, 19th, 20th).



REPUBLIC P-43 LANCER

DESCRIPTION: This airplane is similar in general appearance to the Model AC-119. The power plant is a 1,200 h.p. Pratt & Whitney engine. The wing span is 36 ft. Length is 25 ft. 5 1/2 in. Height is 10 ft. 2 1/2 in. Wing area is 225 sq. ft. Weight empty 2,200 lb. Gross weight 3,200 lb.



RYAN MODEL 26B

DESCRIPTION: This is the standard Ryan biplane which is now equipped with a 100 h.p. Kinner radial engine. Wing loading is 13.5 lb. per sq. ft. Power loading is 21.5 lb. per hp. Weight empty 1,200 lb. Gross weight 1,400 lb.



REPUBLIC P-40 THUNDERBOLT

DESCRIPTION: This is a standard military aircraft and only a few details distinguish it from the standard. The engine is a 1,200 h.p. Pratt & Whitney engine. The wing span is 36 ft. Length is 25 ft. 5 1/2 in. Height is 10 ft. 2 1/2 in. Wing area is 225 sq. ft. Weight empty 2,200 lb. Gross weight 3,200 lb.

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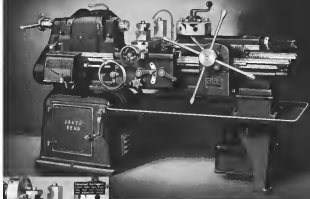
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REPUBLIC P-43 LANCER



RYAN MODEL 26B



## SOUTH BEND TURRET LATHES

DESIGNED for the efficient production of duplicate parts, the South Bend No. 241 Turret Lathe has the precision the mounting, close tolerance operations—smooth power for producing a fine finish—versatility that reduces setup time to a minimum.

The universal carriage has 48 power cross feeds, 48 power longitudinal feeds, and 48 thread cutting feeds ranging from 4 to 24.5 per inch. All changes are made through the quick change gear box at the headstock end of the lathe. Feed and back tool blocks are supplied on the screw feed cross slide. A heavy turret tool block is available to order. A large clearance armature graduated scale on the cross slide headstock permits adjusting the cutting tool with extreme accuracy.

The run-type turret has both power feed and hand feed, with an adjustable feed stop for each of the six curve faces. The turret feed indexes automatically on the power stroke of the turret slide. The quick change gear box provides 48 changes for power turret feeds. Change gears in turret apron provide an additional change for turret power feed, independent of tool post carriage feeds in both rate and direction.

Full advantage can be taken of the higher cutting speeds possible with tungsten carbide tools, as the result of the wide range of speeds and feeds available. The motor spindle speeds range from 15 to 580 R.P.M. The use of a two-speed motor permits quick change from high to low speeds for reaming and tapping operations.

Investigate the possibilities of this new South Bend Turret Lathe—write for catalog and the name of our nearest dealer.

**SOUTH BEND LATHE WORKS**

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LATHE BUILDERS FOR 35 YEARS







TATLOO-CRAFT MODEL T-50-D

**DESCRIPTION:** This is a two-place, all-metal aircraft, which is powered with two different engines each of 55 hp. Outboard, Leveness or Franklin. Wing span is 36 ft., length is 35 ft. and height is 6 ft. 10 in. Total weight is 2,200 lb.



VULTUR BASIC TRAINER-15A

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



VULTUR RESILANT C-4B

This is a shipcarrier high wing monoplane which accommodates a crew of two. Observer's hatch plate is on the right side the rear of ground section—engine, radiator and mechanical devices. The fuselage is stressed vertically by a steel flying



VULTUR F-4H VANGUARD

**DESCRIPTION:** This is a single-engine, pusher, high-wing, low-wing, monoplane having a gross weight of approximately 3,000 lb. It is constructed like the type first reported in China for use against the Japanese. Span is 35 ft., overall length

High speed is 155 m.p.h.; cruising speed is 50 m.p.h. and the steep climb is 500 ft. per minute at sea level.

**DESCRIPTION:** This is the latest Tamm primary trainer of the Army Air Corps. It is a two-place, all-metal aircraft, which is powered with a Continental engine rated at 100 hp. at sea level. It has a wing span of 35 ft., overall length of 34 ft., 6 in., overall height of 14 ft. 10 in. Performance: High speed is 145 m.p.h. at sea level, cruising speed 140 m.p.h. at sea level, landing speed 54 m.p.h. Climb at sea level 1,100 ft. per min., service ceiling 8,000 ft. Maximal range 384 miles. Fuel consumption in cruising speed 14 g.p.h.



TMM F2B-C TRAINER

**DESCRIPTION:** Wings have both top, open, straight ribs and glued and covered. Landing gear is fixed with a trend of 100 ft., in which the 100 ft. hydraulic landing gear. The landing gear is made of aluminum alloy.



VULTUR BASIC TRAINER-15A

area totals 294 sq. ft. Weight empty is 2,000 lb. Gross weight is 2,500 lb. Performance: High speed is 155 m.p.h. at sea level. Cruising speed is 50 m.p.h. at 5,000 ft. Service ceiling is 22,000 ft. Fuel capacity is 90 gal. Maximal range is 320 miles.



VULTUR RESILANT C-4B

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



VULTUR F-4H VANGUARD

area totals 294 sq. ft. Weight empty is 2,000 lb. Gross weight is 2,500 lb. Performance: High speed is 155 m.p.h. at sea level. Cruising speed is 50 m.p.h. at 5,000 ft. Service ceiling is 22,000 ft. Fuel capacity is 90 gal. Maximal range is 320 miles.



HEBCHRAFT TYPE AT-2

**DESCRIPTION:** Wings have both top, open, straight ribs and glued and covered. Landing gear is fixed with a trend of 100 ft., in which the 100 ft. hydraulic landing gear. The landing gear is made of aluminum alloy.



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing

This is a single-engine, pusher, high-wing, low-wing, monoplane having a gross weight of approximately 3,000 lb. It is constructed like the type first reported in China for use against the Japanese. Span is 35 ft., overall length

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HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



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**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE C-4B

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



HEBCHRAFT TYPE 2B-2

**DESCRIPTION:** This is a two-wing, tandem powered with a 470 hp Pratt & Whitney D-2 Super radial engine. It is one of the standard basic trainers used by the U. S. Army Air Corps. Wing span is 42 ft., length is 33 ft. 1 in., height is 9 ft. 1 in. Wing



# AMERICAN AIRCRAFT ENGINES FOR 1942

With sketches and photographs of engines,  
AVIATION presents a cross section of  
American aircraft engines.



Lycoming Division of Aviaton Corp. begins its biweekly  
approved line with the D-103 model, above, rated at 55 hp,  
and 75 hp at 2,100 r.p.m. and 2,100 r.p.m. respectively.  
See Page 513 for complete specifications.



The Lycoming D-103, above, is a 100-hp. type rated at 2,100  
r.p.m. see text. Full specifications are given on Page 513.



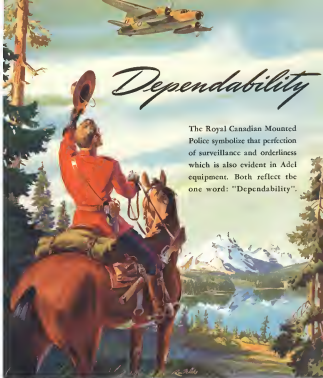
In the 100-hp. class, Lycoming has a 6-cylinder radial engine,  
Model D-103, which has a wet dry weight without fuel  
or oil of 361.4 lb. It weighs 1.13 lb. per hp. and has a  
guaranteed fuel consumption of maximum economy hp. at 25  
lb. per hp.



Lycoming's 175-hp. 6-cylinder radial engine is pro-  
posed on July 1. This is a 6-cylinder type using an Eclipse  
motor. Total dry weight without fuel or oil is 547.4 lb.  
Further specifications will be found in the index page 513.

## Dependability

The Royal Canadian Mounted  
Police symbolize that perfection  
of surveillance and orderliness  
which is also evident in Adel  
equipment. Both reflect the  
one word: "Dependability".



# ADEL

**PRECISION PRODUCTS CORP.**  
BURBANK, CALIFORNIA

EASTERN SALES ENGINEERS: 2 MEMPHIS BILLYN HARRINGTON, MARYLAND  
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# Airplane Parts THAT ARE

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THAN  
ALUMINUM**

**No  
CORROSION**

**STABLE  
IN  
DIMENSIONS**

**T**he physical properties of Formica make it an exceptionally valuable material for many uses in airplane construction. The Formica engineering department has aided the adoption of the material by the development of many specialties for airplane use. It is always looking for more problems that can be solved by the use of laminated plastics and is always ready to cooperate with any manufacturer who has such a problem.

Formica is light, strong, stable in dimensions under changes in both temperature and humidity, it is chemically inert and non-corrosive. And airplanes which operate under such a wide variety of physical conditions require many parts that possess those qualities.

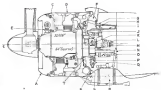
Here are a few that have been made from Formica: Control surfaces, fuel tank sumps and galleys, fuel tank and galley linings, insulating covers, engine window frames, knobs, grips, electrical bakings, buttons, valves and punched parts, air pump valves, bearings, chaffing rings, propeller shanks.

Let us cooperate in the development of others.

**The Formica Insulation Company**  
4428 Spring Grove Ave., Cincinnati, Ohio

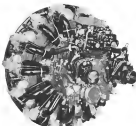
**FORMICA**

The Pratt & Whitney R-2800 is shown below. Newly designed thrust vector plates and the periphery of the oval and the oval between the cylinders so that the air is forced directly into the fan of the rear intake of cylinders. Increases thrust, reduces engine air flow construction and noise as follows. This engine is used mainly in the Republic P-47 Thunderbolt, one of our latest powered planes.

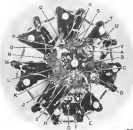


Below is a typical Pratt & Whitney 14-cylinder radial R-1800 engine. The lettering refers to: A—P.C.A. 14th speed main engine; B—side oval and ducts; C—Gasoline and nap gas ring; D—oil and between engine bottom and landing; E—propeller governor; F—oil-pressure pump; G—oil-pressure valve control; H—main control; I—main control; J—supercharger speed control; K—main drive; L—main drive; M—main drive; N—main drive; O—main drive; P—main drive; Q—main drive; R—oil control; S—main drive; T—main drive; U—main drive; V—main drive; W—main drive; X—main drive; Y—main drive; Z—main drive.

This is a 1/2 inch view, below, of the Pratt & Whitney Twin Wasp engine. It is equipped with a mechanical supercharger. It has a cylinder developing 1100 hp. at 2100 r.p.m. at 4000 ft.



A 14-cylinder Twin Wasp G-2 engine built by Pratt & Whitney, develops 1200 hp. at 1800 r.p.m. at 5000 ft. output 20 miles per hour. This is the latest mechanical engine developed for aircraft and export sale, but is representative of our expanding military models in production. For full particulars see article page 114.



The Ranger straightened its line design. Series R-4400 (right) has a power output of 274 to 288 hp. R-44 models have a weight of 270 lb. and use 63 70 10 and 97 micron ball. Positive pressure working is employed. Air pressure is built up at midway engine speed. Through the connecting effect of air is an end toward opening in the case of the cylinder. Consequently in the total wall cavity is drawing an applied the cylinder. The total cooling is in air pressure reserve. Conventional feature of current design model held between the cylinder lower the air around the cooling gas of each cylinder. Total air pressure of each cylinder contains one hour because of the compression apparatus.



The latest Ranger 501 model is a 3-cylinder supercharged radial developing 170 hp at 2200 r.p.m. It has a cylinder head of 340 in. in. and weighs 551 lb. Compression ratio is 6 to 1. Advanced design features include a fully induced pressure lubrication system, mass injected intake valve, 100 percent valve gear lubrication and special bearing steel (Rohr).



The 130 hp Ranger Model 50 engine built by Buell is a 3-cylinder radial type, having a 1000-475 weight of 285 lb. and a displacement of 272 cu. in. 6000 rpm with a 25% in. and compression ratio 6:1. Full conditions from are given in the table p. 314.



There is a lot more view in the (single 1400 model) engine which develops 202 hp at 2200 r.p.m. The per-kiner engine is without automatic valve lubrication. The lubrication system is 4-cylinder 5-hp pump. C-cylinder connecting; D-quadrant; E-cylinder line F-cylinder G-hat hat connector H-hat hat connector I-hat hat connector J-hat hat connector K-hat hat connector L-hat hat connector M-hat hat connector N-hat hat connector O-hat hat connector P-hat hat connector Q-hat hat connector R-hat hat connector S-hat hat connector T-hat hat connector U-hat hat connector V-hat hat connector W-hat hat connector X-hat hat connector Y-hat hat connector Z-hat hat connector. The 1400 is situated in design with the 1400 model rated at 125 hp.



## His ear can hear the soundless song of steel

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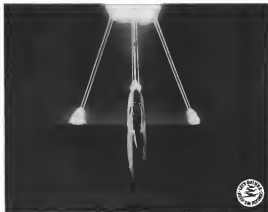
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The aggressor's first hour of shocking treachery is behind us. America is ready to answer on every front. To destroy attackers before they drop their death loads. Bell Aircraft and the U. S. Army Air Forces five years ago developed the world's only single engine fighter carrying a 37 mm shell-firing cannon. Complete fire power, pictured above, consists of a 37 mm cannon and 50 cal and 30 cal machine guns.

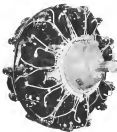
Engineered for mass production, *Mustangs* are streaming off the line. Even increasing this production is now the solemn pledge of every Bell worker.



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AVIATION, February, 1943

In the Q128 series, the Wright Cyclone 9 (right) is rated at 1100 hp for take-off and 775 hp at 17,000 ft. Cyclone 14 powered the older Flying Fortress which were then used in England.



This Wright Cyclone 14, shown, is rated at 1300 hp, and is equipped with a forged aluminum alloy crankcase. It has been reported that this type engine is an alternative installation in the latest B-29 heavy bomber built by the Sikorsky. These engines can also being installed on the Flying Fortress bombers.

A full front view of the 1300 hp, Wright Cyclone 9 of the Q128 series is shown at right. A complete supercharged model, installation is generally similar to the Q120 series with added cooling surfaces and improvements in design and construction.

The Gullstream diesel A-1831 engine is a Veylander radial, rated 545 hp at 1150 r.p.m., one level. Weighing 1111 lb per hp, said dry weight without hub or starter is 555 lb, displacement is 351 cu. in. long and stroke 5 1/2 x 5 1/2 in. Fuel.

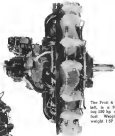


The Wright Cyclone 14 (Q128) is rated at 1300 hp, its cylinder. The engine is shown in its head view is shown. Below features a forged steel crankcase.





The Pratt & Whitney Double Wasp 340 above, is an 18 cylinder engine supercharged military type rated 1150 hp. at 18000 ft.



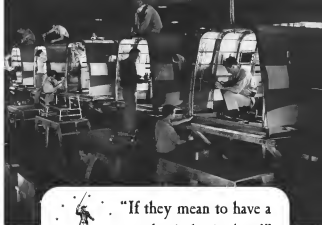
The Pratt & Whitney Double Wasp 340, left, is a supercharged engine developing 1150 hp. at 18000 ft. many 11 cylinder form. Weight is 900 lb. and specific weight 1.07 lb. per hp.



Of the smaller Wright engines is the Whistler T right rated at 550 hp. at takeoff at 2400 f.p.m. At 2300 f.p.m. it is rated 450 hp. at sea level. Full specifications are given in the table page 212.

One of the biggest engines of the type installed on the Douglas B-12 is this Whistler 3000 hp. Wright Cyclone pictured below. Operation tests on performance figures are not allowed, but its construction design follows other Cyclone models.

A full size view below is shown of the Wright Whistler T equipped with auxiliary fuel system engine. This engine is rated at 550 hp. at takeoff.



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—CAPTAIN JOHN FINKE, AT WASHINGTON

In winning this war here, in stream production, good tools are vital. J. H. Williams & Co. will continue to produce aviation wrenches from high-grade alloy steel, according to traditional quality standards. Volume will pass military demands, will be topped up further for civilian requirements as far as available materials permit. Our constant aim is to supply aviation craftsmen and raw operators alike with the weapons

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## responsibility for the figures given

## AVIATION'S CIVIL AIRCRAFT

AVIATION does not assume responsibility

### 4-5 Seats

4-5 Seats		General		Power Plant					Performance					Weight									
Manufacturer	Model or Designation or Model No.	A.T.C. number	Price at factory, \$	Type	Number of seats	Miles of engine	Total rated hp	At altitude, ft.	Fuel capacity (lb.)	Normal range (mi.)	Time consumption (hr. per gal.)	Propeller (dia.)	Maximum (dia.)	At altitude, ft.	Cruising speed (mph)	At altitude, ft.	Stalling speed (mph)	Climb at sea level (ft. per sec.)	Service ceiling (ft.)	Wing loading (lb. per sq. ft.)	Power loading (lb. per sq. ft.)	Wing type	
Albion Aircraft Corp.	Explorer PC-4			W-9			450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Beech Aircraft Corp.	Beech Arrow C-1	438		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Beech Aircraft Corp.	D-17A	713		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Beech Aircraft Corp.	D-175	649		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Beech Aircraft Corp.	D-177	701		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Cessna Aircraft Co.	C-440	701		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Cessna Aircraft Co.	T-30 Twin	722		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Cessna Aircraft Co.	441	707		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Fairchild Aircraft	760	707		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		660		C	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450 S.E.	160	2,150			90	215	19,000	85 S.E.	202	9,700	61	1,000	10,000	14	10	2
Flownet, Inc.		724		CMB	4	500 S.E.	450																

### 6 or more Seats

[illegible]

**Key to Abbreviations Used in All Aircraft Specification Tables**

[illegible]



## AIRCRAFT SPECIFICATIONS

assume responsibility for the figures given

[illegible]

## AVIATION'S FOREIGN AIRPLANE

## BRITISH MILITARY AIRCRAFT

[illegible]

## BRITISH CIVIL AIRCRAFT

De Havilland Aircraft Co., Ltd.	London-Heath Transport	CML	2000		56	15	18																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							</
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## GERMAN MILITARY AIRCRAFT

[illegible]

## GERMAN CIVIL

[illegible][illegible]



## AIRCRAFT

two purely civil types are listed here. Other malformations civil aircraft was listed in the military section.

2.2	6.94	1,145	2,065	39.8	28.9	9	204
		5,140	6,268	30.9	26.9	10	253
				31.8	28.9	11	284
9.83	14.3	1,213	1,832	34.2	24.5	8	188
		18,048	28,869	36.1	26.5	9	214
				36.1	26.5	10	242
				36.1	26.5	11	272
		18,190	22,210	35.3	25.5	8	187
		19,240	25,268	31.4	26.4	9	214
		12,540		35.3	26.4	10	242
29.7			4,360	38.3	26.6	9	239
				35.3	26.6	10	267
		8,800	12,320	35.3	26.6	11	295
			12,340	35.3	26.6	12	323
28.6		13,330	21,250	31.7	27.1	11	265
		6,730	10,250	31.7	27.1	12	293
		4,130	6,270	31.7	27.1	13	321
		4,635	6,270	31.7	27.1	14	349
		1,430	1,490	29.5	24.3	8	172
		1,430	1,490	29.5	24.3	9	199
		2,430	2,590	26.9	21.3	10	226
		4,435	4,595	26.9	21.3	11	254
		4,435	4,595	26.9	21.3	12	282
27.9	11	14,300	22,230	31.8	27.3	10	262
				31.8	27.3	11	290
				31.8	27.3	12	318
26.82	5.49	4,188	5,130	35.9	25.7	9	196
		3,188	4,130	35.9	25.7	10	224
		3,188	4,130	35.9	25.7	11	252
		3,188	4,130	35.9	25.7	12	280
		3,188	4,130	35.9	25.7	13	308
		3,188	4,130	35.9	25.7	14	336
		3,188	4,130	35.9	25.7	15	364
		3,188	4,130	35.9	25.7	16	392
		3,188	4,130	35.9	25.7	17	420
		3,188	4,130	35.9	25.7	18	448
		3,188	4,130	35.9	25.7	19	476
		3,188	4,130	35.9	25.7	20	504
		3,188	4,130	35.9	25.7	21	532
		3,188	4,130	35.9	25.7	22	560
		3,188	4,130	35.9	25.7	23	588
		3,188	4,130	35.9	25.7	24	616
		3,188	4,130	35.9	25.7	25	644
		3,188	4,130	35.9	25.7	26	672
		3,188	4,130	35.9	25.7	27	700
		3,188	4,130	35.9	25.7	28	728
		3,188	4,130	35.9	25.7	29	756
		3,188	4,130	35.9	25.7	30	784
		3,188	4,130	35.9	25.7	31	812
		3,188	4,130	35.9	25.7	32	840
		3,188	4,130	35.9	25.7	33	868
		3,188	4,130	35.9	25.7	34	896
		3,188	4,130	35.9	25.7	35	924
		3,188	4,130	35.9	25.7	36	952
		3,188	4,130	35.9	25.7	37	980
		3,188	4,130	35.9	25.7	38	1008
		3,188	4,130	35.9	25.7	39	1036
		3,188	4,130	35.9	25.7	40	1064
		3,188	4,130	35.9	25.7	41	1092
		3,188	4,130	35.9	25.7	42	1120
		3,188	4,130	35.9	25.7	43	1148
		3,188	4,130	3			

[illegible]

A. — Amphibian.  
A. — Aerial.  
Al. — Aluminum.  
Approx. — Approximate.  
B. — Bepine.  
Bo. — Bolted.  
BT. — Boom to tail.  
Bt. — Berdix.  
C. — Closed.  
Co-op. — Army Co-operation.  
Cy. — Cyclone.  
F. — Furthest Point.  
F. — Flyer's boat.  
Fib. — Fibre.  
Fl. — Flots.  
Fr. — Fried.  
Gen. Purpose. — General Purpose.  
Ho. — Army's hook for  
— "i" section.  
Id. — Inverted.  
I.F. — Frigate-Franchise.  
L. — Landing.  
M. — Monoplane.  
Me. — Metal.  
Mil. — Military.  
Mo. — Monocyte.  
Mu. — Multitude.  
O. — Open.  
Oc. — Occ.  
Pa. — Paggio.

1,963	2,209	34.8	25	6.8	195.2
1,653	3,032	28.5	63.7	6.5	141.6
18,190	30,910	86.11	23.7	22.2	914.0
22,501	36,332	93.3	43	24.6	1076
4,300	4,300	100	0	8.8	269.0
10,475	14,883	64	46.9	13	635
20,000	29,225	93	67	16.1	
19,875	24,264	62	64.7	16.4	849
15,200	18,150	75	33	17.8	817.2
16,742	29,115	79	57	19.5	1072
1,663	2,315	28.6	21.6	8.2	236.2
2,059	2,051	31.2	25.5	6.7	189
20,940	5,407	62.3	17	17.8	817.2
36.5	22,660	92.3	31.3	13.6	646

[illegible]

47	63	24.3	
42.7	52	13.1	
20.8	32	14	
9.8	10	11.4	
75	63	12.6	
50.6	25	0.9	
82	52.4	12.4	
95.9	20.9	26.3	
18.3	11	10.6	
5.369	27.11	6.3	253
11.000	39.4	12.1	
46.2	27.9	11.9	
35.2	32.6	11.9	
46	24.4	11.9	
45.2	32.10	8.9	
36.9	33.6	11.5	
35.5	25.7	7	
26.11	17.6	9.0	
26.11	17.6	11.1	
45	25	25	
38.1	27.11	13.11	
42.11	32.9	11.5	
42.11	32.9	15.1	635

[illegible]

\* Most Japanese military aircraft aircraft are either copies of well known foreign types, or foreign types built under license. Thus Japanese military markings will be seen to resemble Hindustan, Fiat, Curtiss, North American, Boeing, Northrop, Martin, Seversky, and other foreign types. Japanese markings are all designed after foreign types. Many of the Japanese aircraft are of obsolete design, and for that reason are hardly considered to present any real difficulty to present-day identification. Type numbers go according to years on the Japanese calendar, thus aircraft built in 1936 are identified as 36 machine etc.

[illegible]

[illegible]

**AMERICAN AIRCRAFT ENGINE SPECIFICATIONS**

[illegible]

Section		Description		Quantity		Unit		Value		Total		Grand Total	
Item	Code	Item	Code	Item	Code	Item	Code	Item	Code	Item	Code	Item	Code
1	101	2	102	3	103	4	104	5	105	6	106	7	107
8	108	9	109	10	110	11	111	12	112	13	113	14	114
15	115	16	116	17	117	18	118	19	119	20	120	21	121
22	122	23	123	24	124	25	125	26	126	27	127	28	128
29	129	30	130	31	131	32	132	33	133	34	134	35	135
36	136	37	137	38	138	39	139	40	140	41	141	42	142
43	143	44	144	45	145	46	146	47	147	48	148	49	149
50	150	51	151	52	152	53	153	54	154	55	155	56	156
57	157	58	158	59	159	60	160	61	161	62	162	63	163
64	164	65	165	66	166	67	167	68	168	69	169	70	170
71	171	72	172	73	173	74	174	75	175	76	176	77	177
78	178	79	179	80	180	81	181	82	182	83	183	84	184
85	185	86	186	87	187	88	188	89	189	90	190	91	191
92	192	93	193	94	194	95	195	96	196	97	197	98	198
99	199	100	200	101	201	102	202	103	203	104	204	105	205
106	206	107	207	108	208	109	209	110	210	111	211	112	212
113	213	114	214	115	215	116	216	117	217	118	218	119	219
120	220	121	221	122	222	123	223	124	224	125	225	126	226
127	227	128	228	129	229	130	230	131	231	132	232	133	233
134	234	135	235	136	236	137	237	138	238	139	239	140	240
141	241	142	242	143	243	144	244	145	245	146	246	147	247
148	248	149	249	150	250	151	251	152	252	153	253	154	254
155	255	156	256	157	257	158	258	159	259	160	260	161	261
162	262	163	263	164	264	165	265	166	266	167	267	168	268
169	269	170	270	171	271	172	272	173	273	174	274	175	275
176	276	177	277	178	278	179	279	180	280	181	281	182	282
183	283	184	284	185	285	186	286	187	287	188	288	189	289
190	290	191	291	192	292	193	293	194	294	195	295	196	296
197	297	198	298	199	299	200	300	201	301	202	302	203	303
204	304	205	305	206	306	207	307	208	308	209	309	210	310
211	3												



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**Closed Type Filtrings**



**John F. Kennedy**



Journal of Management Education 35(1)



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1



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## The Seed and the Timber...

**F**EBRUARY 1908. Two men, fresh come from the frozen lake which has covered them as a flying disk, are waving in a roomy cedar stove. Their faces are flushed, partly by elation, partly by the warmth of the room after the icy bite of the winter air outside. The younger of the two is scribbling excitedly in a diary, the words "leading steadily, step-by-step" from his pencil.

"Today we flew!" Yea, after all those weary months of work, we have won it. 225 feet in one straight flight! Even now I can hardly believe it."

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## 19. FIBERS

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## 14. GASET

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Circumstance	Percentage of respondents (%)
(a) self-defense	95
(b) defense of others	85
(c) defense of property	75
(d) defense of a community	65
(e) defense of a nation	15



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They're time-consuming and labor-wasting—those burring operations as now carried on in many plants with bench after bench of workmen removing excess metal with hand files, burring tools, emery cloth, etc. And it's a tricky job to maintain proper tolerances and measurements when using such tools.

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In writing for further information give full details of the burring operation to which you wish to apply the LEA method. The part, metal and nature of operation have an important bearing on the buff and composition selected.

Aviation engine tested at Lehigh University, Lehigh, Pa. (Left) and at Lehigh University, Lehigh, Pa. (Right) in testing burring process.



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## SIDE SLIPS

IS THIS STORY WE ASSIGNED the "Side Slip to Cars" program, under which the airplane industry would take over the automobile industry (instead of waiting till the auto men took us) we've been feeling a little bit sorry.

But now we realize it could. For Mr. Leon Henderson has put the auto people out of business, and we airplane men don't have any dirty work to do. All we have to do is wait till the war is over and start making the People's Airplane.

The automobile goes anywhere, any time, and if we can make a plane that



will do it, nobody will want cars any more. It would be the opportunity of the century for the flying machine business.

All we have to do is design the People's Airplane. You may think that this will be hard to do. We thought so too, till just the other day when we ran into Charlie Plank. We had argued with all schools of thought on the best proof plane for a good many years and got nowhere. It started back about the time of hot lunches on the airlines.

One school, headed mostly by pilots with up-curved mustaches, and so forth, insisted that a plane had to go fast or no one would want it. To prove this they would tell about the times they had started out in one of those 50-mile safety planes and run a hairdresser and the same started passing them along the way and they got depressed and went back home.

We used to fall in with this school of thought—while they were talking. Especially after we, ourselves, were passed by cars on the road. We weren't in a plane when this happened, though. We were in a limo. Heading toward the old Hoover Field at Washington, one day, we were invited to go with some news photographers in a limo to a bank fire. The camera men told the limo was out there 20. We went out that road and the cars kept passing us, all the way, and we found out how a limo feels.

Then the other school of thought contended that safety was what people wanted, not speed. This was the school that built the planes that anybody could fly without any license. We fell in

with them, too—while they were talking. One of those fellows took us up one time, and he came down and flew right in between a couple of barges and set his three wheels on the pavement and stopped, just like a dry cleaner's delivery car. It was good performance, and no two ways about it.

Well, the speed school and the safety school have their points, but they still haven't sold any ten or three million planes, like the automobile people sell cars.

As we said, we had thought, along with a lot of other people, that it might be pretty hard to design the People's Airplane. We kept on thinking to till just the other day. And then came along a man of vision, an optimist on the People's Plane situation.

This man is Charlie Plank, an old friend of ours, who has been writing about aviation for years. Mr. Plank says there is now a third school of thought on how to build an airplane that the auto men use as the stress. He agrees with the new school's idea: 100 percent, is even willing to hand up the cards. He doesn't even mind if you call it the "Plank School." Has a slogan, too, to run the movement under: "You Can Fly a Plane if You've Got the Power."

"Has your school designed a People's Airplane?" we asked Mr. Plank, getting on to take some morning notes. "No," said Plank. "But I'll do it now if you're got time to wait." He reached for a pad and began to draw. (Turn to page 100)



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By CRAIG WALSH

## Transmitting Antenna and a Directional Loop for Aircraft

A deluxe trailer wire transmitting antenna (AVA-41A) for airplanes is announced by RCA Manufacturing Co., Camden, N. J. Experiment with aircraft material has shown that trailing wires which can be released or retracted at will combine high operating efficiency with convenience of operation. Readiness of operation was of prime consideration in the design of this new antenna.

The reel which holds the antenna wire normally remains locked at all times due to its internal locking mechanism. To release the antenna wire from the reel, the user merely gives the handle of the reel a partial turn in a counter-clockwise direction. This releases the internal locking mechanism and allows the reel to turn freely. The pull of the rubber drag-rod on the end of the antenna then draws the antenna wire from the reel. When the proper length of wire is out, as indicated by the turn counter on the reel, the handle is released and returns to its original position, immediately locking the reel. The wire is retracted by pulling it in, as the manual counter, the counter returning to zero as the wire is wound on the reel.

This design is such that the antenna

can be completely operated with one hand, leaving the pilot's other hand free at all times for operation of the airplane. In addition, should the full extension of the pilot be required for other matters and he must suddenly cease operating the antenna, the handle instantly locks the reel and it remains locked until it is further operated.

The AVA-41 antenna is designed for installation in any type aircraft and is recommended for use with transmitters of 50 watts or less, at frequencies from 2,500 to 15,000 kilocycles. The antenna may be installed in an airplane in a variety of ways. It may be installed with the antenna passing through the entrance fairlead attached to the top of the fuselage and through the rear guide fairlead situated on the top of the radiator. A flexible conduit may or may not be used to carry the wire from the reel alongside the pilot in the entrance fairlead. When mounted in this manner the length of wire between the entrance fairlead and the rear guide fairlead, with the antenna reeled in, is sufficient for short distance ground communication. Thus a pilot may be in contact with the control tower while taxiing, landing or taking off. Another method

## RADIO

of installation is to carry the flexible conduit through the body of the airplane in a pipe underneath the radiator, where the wire may be let out to trail behind the plane.

A directional loop antenna for use on light airplanes is also described in new literature by RCA. It was designed as a compromise piece on the AVS-100 and the AVS-105 antenna systems and may also be converted to other types of receivers having sufficient sensitivity by the use of an adapter. The loop is intended for installation on top of the fuselage, but it may also be mounted underneath with equal performance with the trailing of the dual slightly less convenient. The loop itself is 12 inches in diameter. The inductance is 40 microhenries, the distributed capacity, 20 microfarads and the resistance is 25 ohms.

## Interphone Unit Announced by Electronic Specialty

A new E-Special interphone unit designed especially for the rugged aircraft requirements of electronic specialists has been developed by Electronic Specialty Co., of Los Angeles. The device is contained in a metal case measuring 3 1/2 by 3 1/2 by 1 1/2 inches and weighs 4 to 4 1/2 lbs. Provision is made for two microphones and two headsets, or in other words, two persons may communicate with each other. Either closed microphones or the conventional push to talk microphone may be used. Approximately 250 hours of operation may be obtained from one set of dry batteries.

## 4-Pound Transmitter-Receiver

A very light radio transmitter-receiver operating on the 100 megacycle frequency is announced by the Communications Division of Wilcox Corp. of Detroit, Mich. Although designed for operation on just a single frequency, this frequency may be altered to any channel in the band from 112 to 130 megacycles by means of a screw adjustment. Power is obtained from self-contained batteries which provide about 2 hours of continuous operation. This is equivalent to a one hour radio aerial installation operation of about a week to about a month. The range of this unit is about a mile. It is provided with on-off switches and a frequency-tuning transmitter dial.



These communications between two persons in an airplane is provided by this two-way bi-phase interphone. Also shown are the shock absorbing mounting brackets for the conventional microphone, the closed microphone and the headphones.

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## THE AVIATION

# NEWS

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C. E. F. Mendenhall  
New York

February 1942

### FO R's Airplane Program Will Triple Axis We Must Average 5000 Per Month by July

Washington (Aviation Bureau)—When President Roosevelt called for 100,000 airplanes by 1942 and 1943, he probably had the scaling of the air program for this year. One objective has been doubled several times since March, and this new goal, which includes doubling our 150 per month production schedule, is no doubt the best.

It is estimated that if enough of the engines and materials of the industry are applied to building airplanes, about any number can be built, at a rate far ahead of what any other country could do. But the rate of production the President calls for, 10,000, or an average of 5000 per month in 1942, and 15,000, or 15,000 per month in 1943, brings the Allied race to those in four years the most, more of the Axis. This should be more than enough to break the trade alliance, showing that all possible disadvantages are on our side.

Two more are open to learn our airplane output from what it was to what the President requires, conversion of non-military plants, expansion to plant production, which means largely the automotive industry, and the construction of new airplanes.

Two more are open to learn our airplane output from what it was to what the President requires, conversion of non-military plants, expansion to plant production, which means largely the automotive industry, and the construction of new airplanes.

plants, which means largely expansion of the American assembly plant plan. The latter is true because we are going in for large-scale bombing, to take care of a war spread over great distances. Accordingly, our emphasis on bombers makes the President's program, stated in units, more of the same stepping, to fast the public has not accepted.

Then, there being no question of the method, or of improvement, or of materials, achievement of the objective is a problem in organization and drive, including considerably more 1-4-40 operations.

Before the President issued his directive into the industry's lap, we were entering the year 1942 with a previously-estimated monthly rate of 1500. At the rate we were going we would have hit just under 2000 by the end of 1942. Originally, we were aiming at 4000 per month by July, 1942. To meet the President's program, we must hit an average of 5000 a month by next July, and go from there to an average of 7000 per month by year end, to reach in average 10,000 per month for the entire year.

Almost all returned people seemed to feel that the military



They made the war plan that U.S. will follow in months to come. L. to R. Major General Henry H. Arnold, Chief of War Plans, Admiral William D. Leahy, Chief of Navy Plans, General George Marshall and Admiral King. Do these men have responsibility for our overall strategy?

average of over 10,000 in 1942, would be more to achieve than the 5000 average in 1942.

### Billions of Dollars For Military Plans

Appropriations without limit are made for the military air program. Congress will grant any amount that is reasonably justified. In the Third Supplemental National Defense Appropriation, passed late in December, providing a total of \$1,071,680,000, airplanes and parts and accessories are given \$178,000,000, both Army and Navy. Of this total, the Army Air Corps got about \$75,000,000, and the Navy Bureau of Aeronautics, remained about \$280,000,000 in each year \$842,000,000 in contract authority, including \$56,000,000 for additional plant facilities.

The National Advisory Commission for Aeronautics is authorized to make new contracts for aircraft, aircraft, and a third of the end cost, for the progress of the aviation industry.

The \$18,000,000,000 (184 billion) just authorized by the President, which encompasses a total of \$100,000,000,000 by

July 1944, given the Air Corps, for all purposes in fiscal 1942, \$1,000,000,000. There is no breakdown of air program.

Navy Bureau of Aeronautics, for construction of aircraft only, \$171,415,000. There is no breakdown of air program.

Meanwhile, a new appropriations bill, ending for fiscal 1943, \$1,000,000,000 out of several billion was expected as this was written, to speed the \$1,000,000,000 program on the way.

### United States Air

A series of civilian defense handbooks prepared by the U.S. office of Civilian Defense, has been issued. Purpose is to instruct the defense worker to his duties. It is a total plan of Civilian Defense, the Air Staff. War-time Service may be set up under the chief of Police or to an independent group. In either case, there will be a Chief Air Staff. The number of administrative units will depend upon the size of the city or town under the Local Defense Organization. The book is on sale for 10 cents by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C.



Weight-lifters are turning out these CGO's for the Navy and by-way off-liners are made daily from the Strategic Field.

## War Brings Strict Rules on Private Aviation U. S. Is Only Country Where It's Not Granted And Thousands Will Join Civil Air Reserve

Washington (ANTAGONIST) Service—The new Civil Air Reserve is a hot bed, but it's still in the air. Work is better than you can get for the non-military and non-military groups in any other belligerent country. The impact of war, coming to other countries, has brought private aviation out on the ground, where it will live. Except in Russia. There they have a sort of half-and-half private-aircraft army which is flying.

It was the first-hand work of the National Aeronautics Association, and various state and national aviation organizations, that helped to win a spot in the air for private planes during the war. Representatives of these agencies worked to demonstrate to the Government the value of private planes that are permitted to operate, and in the national interest, too.

The Government had a good reason against private planes "going flying" during a particularly war-torn period. It was that there was no place in the air and not under complete surveillance. Private pilots have now a privilege and a responsibility, and the Administration has shown its true democratic colors, in emphasizing civilian flight, though more strict control.

Primary advantage of private aviation in the Civil Air Reserve, which now has official status, with an Air Force commander. Personnel of CAP are no exception and varied that in-

most any citizen, with or without aviation training, who can prove his good will toward the country, can find a place in CAP. If developed to its full possibilities, this can be an important power in the war. (See page 52, this issue).

Not all pilots will be in CAP, however, but they will be permitted to fly. Here are the regulations that came as a result of war.

1. All non-military and non-scheduled plane licenses were suspended when hostilities began.

2. Still more the re-activation must allow any pilot who proved himself a loyal citizen and his license re-activated.

3. Then the Government made a step further and gave pilots who are citizens of this country the right to fly to the United States and their license re-activated.

4. CAA forbids Japanese to fly or carry any plane to the U. S. or to any other place in the world, or to any other place in the world, or to any other place in the world.

5. If any airplane is left unattended it must be removed to a safe place by means of its pilot.

6. The Civil Air Reserve Board has issued some rules. It said that the license of private carrying private planes must be inspected by the pilot, and the pilot must show any certificate of registration of the plane, where they could not be reached.

7. After January 6, every

private pilot must carry an identification card, bearing his picture, his finger prints, and other information.

8. The owner of an airplane should not permit it to be flown by any other person not having the required certificate and identification card.

9. No unauthorized plane may take off until it has clearance from a police officer or the police representative at a landing area. To get this clearance, the pilot of the plane must file a written statement, with a flight plan, and he must show that he conforms to all regulations. Under certain conditions the Air Force Inspector concerned must be advised, by the commanding officer, of such flight.

Of course the Army can suspend permission for any flight at any time upon request of the whole country, for such period as it may fit.

Private aviation was in Washington selected this was a lot of red tape to break through, but they said it was necessary, and that it is better than being tied to the ground.

Meanwhile, the Civil Air Reserve Authority made known that it is trying to keep the private pilots out of the war and regulations down to about half what it is now.

## Rubber For Airplanes

A serious rubber shortage from the United States and elsewhere the airplane industry. CAP has produced a lot of military requirements for rubber. Rubber-proof gas tanks or Flying Fortress use 3,500 pounds of rubber. The P-40 uses 2,000 lbs. tank alone 20 pounds. Permeable rubbers used by airplanes are 20 pounds. Two lb. planes require from 25 to 30 pounds each and other sub-jects from 24 to 300 pounds.

CAP suggests that no man use any amount of petroleum with rubber in the American market as a large-scale growing process of synthetic, a rubber-bearing direct source, and enlarges the production of synthetic rubber. Only the last of these offers any possible remedy. Four plants owned by the DuPont Plant Corp. are now being built and will total over 40,000 tons annually, capacity to be tripled by the end of 1943. This makes for only a small fraction of our annual 300,000 tons consumed before the war.

To produce annually 120,000 tons of synthetic rubber, rapid process of hydrocarbons and benzene.



International Date

Dr. Sanford A. Moss, General Electric Co. scientist who supervised the development of the atomic bomb, is shown in a Republic P-40 fighter plane, as a recent visit to Republic's Long Island plant.

These ingredients of the general purpose type of synthetic rubber, will have to be made for months time and self-healing positive tanks for military aircraft will be first to get the rubber.

To speed production of bullet-proof fuel and oil tanks, a high priority rating covering the construction and shipping of a plant in Los Angeles has been given the U. S. Rubber Co., and is expected to be producing before the end of spring. Airplane tires are also subject to the rationing of the War Relocation Office. All war needs will be met regardless of the peak in civilian.

## Civil Flying in Chicago

Swearing in from the People like no other job, the war there is a very busy time. CAP is now, concentrated and mobilized, flying at a 100 mile military mission near the People's Coast. All that there were some 100 in the big air wing and CAA officials might be interested in some of the most interesting flying, especially in connection with CAP operations.

20 new days have been set at least for the present there will be nothing but military flying in the central zone. The military flying is all along the coast, attacking coast-line shipping and sailing for a very heavy military reconnaissance and bombing effort—which

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seems to have been quite successful. Alas, it is rumored that one of the civil pilots staged an unauthorized flight, almost

The Colquhams, Wing of the Civil Air Patrol, though temporarily grounded as a proceeding airplane at an airport under Commander Belmont's close watch, he has no doubts that it will be repaired, and that the Colquhams will serve wherever in future it may be called on by the Army. One Civil Air Patrol Squadron, for example, made up of members of the Los Angeles County Sheriff's Aero Squadron, is assigned to fly the plane.

One of the subject figures in West Coast civil flying circles was Bertrand Pines, California Wing Commander of the Civil Air Patrol, a Wing Commander without any wings. And at last writing no letter had yet opened up in the cold moment to encourage the civil pilots, although it is generally believed that military work will be found for some of them in the near future.

[illegible]

Concerned over reports and rumors of operations, generally against the army, the government has taken steps to increase its control. The personnel is rapidly increasing into the seventh division. The Army is believed to have been ordered to take over the One Stage operation was extended out of its boundaries on its orders. The army was reportedly to be successfully prevented to higher military authorities and the army was ordered to be left intact who proved to be the army's main strength. Many are being sent to the army's main strength, forced into the army's main strength with the army that they are not to be sent to the army's main strength, indicating that the Army units are making every effort to do so.

Planes enroute to the combat zone are being down-encountered. Many are being shot down, some are being shipped to in some parts, but a very large number of captured, still washed, people down and airplanes are God down a long row along the borders of some busy flying field.

Coke during 1940. He is now storing his equipment and maintaining personnel in ponds on wooded parts of the island. Interiors Armed & Engineering Corp. is still manufacturing Coint

## THE WASHINGTON WINDSOCK



By BLAINE STORRLEFIELD

**Explosive analysis:** Japanese cities are not made of paper, and they have been fire protected in recent years by capable engineers; a great many Japs can shoot straight, even though they are obviously Nipponese; Japanese airplanes are good enough to be highly effective until the Allies can bring air forces to bear against them; the Sons of Heaven are not superstitious, but they are good enough.

**Prone pilot position:**—means you lie on your stomach at the controls, as being used by all air forces, to prevent cockpit trouble. The contraindicated action on your blood is crosswise of the body, in a prone position, instead of away from the head. It's not a pleasant solution, and don't bet on when will come of it. Another expedient, if please god Dostoy, will be to make only long easy turns, and make straight-away passes at the enemy, with a one-stroke burst of fire. Of course he will do the same at you.

**Some airlines may say that air marking helps pilots in training and tactical work and we need more of it. Others say the markings would help any attacking enemy and should be limited out. At the writing it looked as if the markings will be issued for hundreds of miles down the coast.**

**Men of action** are leaving the government agencies that don't fight with rifles and prove courage on grass. Grant Moore was an early departure; he left his post as a member of GAE to help run the Army lines in South America. A few days later went General Connolly, CAA Administrator, back to the Army. We saw a war plan in some other important eyes, and expect to miss them any frosty morning now. One morning, based on the fact that the members of

**Perfect cooperation,** is what Washington says it is getting from the airlines. You hear nothing but praise for the transport men, who are asking nothing but a pay-rate that will start their increased costs. Every day seems to take the heat further from the possibility of being commandeered by the Government. True, our transport is totally an instrument of defense, and is under command of the Army, but it collects its own fare.

The British have been much about our separate air force problem, one way or the other. They could exercise strong influence on us if they wanted to. In fact certain persons have asked them to. Successful air attacks on many vessels, and the action in the Philippines, were hurrying the question to a tryout in Congress at this writing.

**Blow-up anti-tank planes**, recently reported, is probably a special job carrying a 50mm gun, like several British and American attack planes. A British officer told Windbrook that if RAF had used 27s on Nazi tanks in Africa, he didn't get know the results. But he said 27s would be devastating to tanks, submarines and especially locomotives, whenever one could get close enough to pour it on.

A balance will be struck between the American demand for a huge army and the demand for stability of war. If you put too many men in the field, you take them away from the manufacturers of the machines. A preponderance of tanks, airplanes, warships, and efficient guns does proportionately more damage (than a lot of soldiers on such costly do, and does it with less loss. President Roosevelt's \$10,000,000,000 1942-43 blueprint for war is intended to get speedy results with minimum loss of life.

### Air Officers High in Pacific War Command New CINCUS Was Chief, Aeronautics Bureau

Washington. "The Air Force must be able to do it," he said. "It is hardly surprising that the Army's top aviation officers hold very different views on the subject. I am not sure they are right or wrong."

Asst. Lieut. Gen. Indo C. Kwan, commander of the Army Air Force Combat Command, is one capable authority on the subject. He has been in the key stronghold of the First Cavalry, General Kwan is known as a standing principal in long-range bombing operations. He is called "Young Old" (Observance Post) and doesn't carry a rifle.

An Indiana training school is an example of the number of photo-mechanics at Fort S. Oklahoma. Most of the time, take-offs and landings in front of the school are stressed. During the case period, simple machine accidents will be held in factories, places and, where they will

by the Far East now focuses in-creasingly on new areas, says under the aegis of two foreign companies.

Chimes and its English subsidiary, the South China Cold Storage Co., are active in China, including American, British, Dutch and Japanese firms, but, says the unit, its eye currently is on the U.S. market. P. Maori in China, and each portion of Indo-China and Thailand may be prime venues.

For instance, the U.S. Cold Storage Co., a subsidiary of China Cold Storage, has negotiated contracts for all kinds of meat and fish products, including those of the United States, and is now negotiating similar contracts in Japan and elsewhere.

Dr. Col. W. Ford, Field Artillery, a member of the staff and instructor at the Ford Artillery School, Fort Sill, Oklahoma, is an alumnus of the training program.

They are the Boeing-Douglas-Vega pool for the production of Boeing B-17's, the "Leadere" or "Midwestern" bomber assembly program, for the produc-

Thus, U. S. air officers command and control, and are in command in the East. Admiral Thomas C. Hart, commander of the U. S. Fleet in the Pacific, will direct sea forces under Warrent.

Arlotte stepped further up the military authority when Admiral Ernest J. King, commanding the Atlantic Fleet, was designated Commander in Chief of the United States Fleet. Admiral King was formerly Chief of the Navy's Bureau of Aeronautics, and he was a pilot, aircraft and auto manufacturer, including Packard, Ford, Studebaker, Chevrolet, Buick and others.

These sailing pools, especially the Keweenaw and engine combinations, will be expanded on a vast scale, and no doubt new combinations will be set up

### Light Planes Accepted For Army Fire Patrol

To improve air observation for the ground army, the War Department authorized one infantry division and one corps artillery brigade to have one plane, pilot-mechanic, and maintenance crew for the purpose of testing observation for field artillery. "Light planes" will be used, it is reported, following highly successful experiments in aerial maneuvers. The

type is called "Flying OP" (Observance Post) and observes artillery fire.

An Indonesian training course will be taken by an unannounced number of photo-mechanics at Fort Sill, Oklahoma. Low altitude flying, take-offs and landings in limited space and field maintenance will be subjects stressed. During the course period, airplane mechanic candidates will be sent to factories manufacturing the type of planes used, where they will receive instruction in repair and maintenance.

Lt. Col. W. W. Ford, Field Artillery, a member of the staff and faculty at the Field Artillery School, Fort Sill, Oklahoma, is in charge of the training program.

### Services Freeze Models But Research Continues

Three big airplane plants and sub-assembly plants are now in the last stages of preparation and getting into production. They are the Boeing-Douglas-Vickers plant for the production of Boeing B-17's at the "Boeing" headquarters' location, assembly progress for the production of four-engine Consolidated B-24's and North American B-25's, and Martin B-26's, both machines which required highly specialized design work made by the automobile industry, and the aircraft engine plant between aircraft and auto manufacturers, including Packard, Ford, Studebaker, Chevrolet, Buick and others.

These existing pools, especially the Kaibab and engine combinations, will be expanded on a vast scale, and no doubt new combinations will be set up.

More than one-third of total aircraft engine horsepower, existing and engine plants to be operated by the automobile industry and their percentage may increase. Packard production of 1938 up. Radio-Rayco engines in use well under way. Ford has been producing a limited number of 1930 up. Pratt and Whitney engines and will be quickly production early in the year. Most of the units are in place in Stoddard's plant which will



Symbolic of American youth's urge to "get in there and fight" is this picture of 1100 young men who crowded on Governors' Island last month to take physical exams for Flying Cadet training. Thousands more are sent by both Army and Navy.



All over America maintenance mechanics are spending up their work on military ships. This sign, on a Navy ship at Norfolk, Va., is typical of the general nature of overhead labor.

**Ferry Pilots Wanted**  
The Army Air Corps Ferry Command will employ unlicensed pilots to ferry aircraft from the Army Air Corps Ferry Command to the Army Air Corps Ferry Command.

Augmenting the pooling system will be further confirmation of existing facilities so that stoppage of production because of plant damage will be held to a minimum by transfer of operations to another plant.

There will be direct types of labor items, such as construction of the new barracks building by the services using their own funds, or housing construction, or feeding programs out of the talk stage into reality, new that was in here. One well-known fighter plane is on its way out and the plant is changing over to another design.

### Ferry Pilots Wanted

The Army Air Corps Ferry Command will employ combat pilots between 21 and 46 years of age with 500 certified flying hours, and at least 250 hours in aircraft of 400 hp or more. A preference is an unexpired tour and the applicant must have a commercial license. Enrolled as temporary Civil Service only.

temporarily. Civil Service employees at \$5,000 per year in salary, the Christmas ferry pilot at the end of 30 days will have opportunity for advancement in the Air Corps according to rank or age. They may also be kept on Civil Service at a raise in pay. For diam expenses of \$5 will be paid for domestic trips from home stations and \$5 abroad.



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LINDEN - NEW JERSEY - U. S. A. INSMITHING and RESEARCH CORP.

### War Doubles Bomber Plan, to 1000 Per Month in 1943. Ten New Plants. Plus Auto Industry

Washington CAVIATION Bureau.—Why industry brought an order on the manufacturer is linked to the entire aircraft industry to stop it as double it is, in production, and that it is clear out of work. Wags and men of this kind are not unusual, but surely bigger contributions of the people mean divine power to war, make more jobs, more labor, more. If we will not them, and where they will be, you will not take—possibly not even when they get into government. Any more error would give them they might be converted in the coming time, and that the same people might run them. But this is not necessarily so, for there are chiefs, train carriers, and would-be for long before.

But the new limited job training program, especially, (2) it put up pressure for advisers, on the basis of which it is now expected we will reach the \$500-a-month goal this year. (3) It was decided the already limited and overvalued program is to be divided again to bring production

One of heavy bombers to 1900 a month in this mid of 1943.

An GPM could be the midsize military gun before, and the size of the gun is necessary plants for inland to assemble craft of parts mostly made by the side industry, as again it calls on the one means industry. The size gun's main part is making parts for the sub-assembly. The probable

Probably one of these designs, or a combination of both or some of them, will be adopted and mounted to several bombers in the future. The Navy and the Army and Navy took advantage of cooperation between manufacturers and kept on trying numerous designs. But these days are gone. Bigger-and-bigger outcrops many times more important than the

History's impact on enterprise is on, with a \$5 billion dollar budget that may be expanded at any time. During the next six months, or more, one of the main jobs in this enterprise will be done: the re-joining of the two separate Kennedy Center as the same amount of funding that can be used as it stands are at each location.



Auto industry converts to defense jobs. Here are mechanics at the Detroit Fisher Body plant who are building jigs and fixtures for tooling for the North American B-28 bomber. Jigs will go to the Fisher plant in Maconville.

A black and white photograph of a biplane on a runway. Two people are standing near the aircraft, one near the tail and one near the wing. The background is a flat, open landscape.

Tiger's production model of the Aerosol Trainer. Plastic-headed screws is used throughout this interesting ship.

### Time Trainer

there is no point in quoting them. You can read the real facts when the capsules of industry and war write these numbers.

### Vulcan-Consolidated Merger

### Valtzee-Consolidated Merger

Consolidation of the Valtellina-Comasoglio merger brought the community of 50,000 to 30,000.

Major Fleet serves as Vice President and Director and a representative of the Board of Directors of Consolidated Aircraft. Major Fleet serves with Consolidated Aircraft Corp. as an advisory staff member.

Named as Chairman of the Board and Chief Executive Officer of Consolidated was T. H. Gaudin, former Westland and

code fleet as President of Consolidated, and Richard Miller, president of Yulke Aircraft, has been named Consolidated's executive vice president. In addition to Chaffin, Woodward and

### Kleiner Cats: Serap

Dr. H. H. Laidlaw, C. T. Leigh, I. B. Manning, Donald N. McMillen, Wm. G. McDuffie, E. S. Pratt, F. D. Schanda, and E. Seidman Wilson.

At the same time a recognition of the Value board of Directors placed T. M. Glicker as Chairman of the Board and Chief Executive Officer, Richard W. Miller, as president, and Harry Woodhead as executive vice president. Woodhead announced that he would devote the major part of his time to consolidated production problems. The Value board of Directors includes: T. M. Glicker, Richard W. Miller, Harry Woodhead, L. I. Hartman, L. E. McMillen, J. H. McDuffie, E. S. Pratt, F. D. Schanda, and E. Seidman Wilson.

## West Coast War Effort

New operating is a full-sized civilian race car. The victory industry along the Pacific Coast has reacted to the war demand for increased output, like a champion runner just getting his second wind.

Having staged a record expansion of production during hectic post-army conditions of 1941, everyone is confident that the production schedule can be tripled in 1942. Characteristic of all plants into the new movement is that they are the business production schedule was completed by 70 percent. Employees, in big plants, 1941, workers are doing on 30 hr schedules, 7 days a week and the spirit with which the work is being tackled is even more significant. Workers of Volvo voluntarily get together and added to be allowed to work one Sunday without pay as a contribution to the defense effort. The company promptly responded by offering to contribute the materials and during the "bonus day" production effort.

Employees of the Canine Electrical Development Co. responded to work on extra day and Sunday (they are normally paid an extra day) to help the company's expansion to meet the demand.

All plants are interesting the things of women. A previous war 30,000 women workers at one time is already under way. They are being paid the same wage scale as men doing similar work. However, some trouble has arisen as a result of a California State law which does not permit employment of women in industry between 11



Larry Lawrence, right, was given a dinner by members of the American Writers Association in New York recently. John Fennell, AWA President, is above left, and Guy Vaughan, Dallas-Wright president, center, who a cartoon Larry received.

p.m. and 6 a.m., not for more than 8 hrs. in any day or 40 hrs. in any week. It is believed that these restrictions will be relaxed very soon in order to make women into the spirit's production line.

Some labor trouble resulting has resulted the past alone effort almost universally undertaken by management and labor. A CIO strike has been threatened against the 3000 Army aviation units at Consolidated Aircraft Corp. demanded double time for Sunday work instead of time and a half.

Two other aspects of the battle for production developed immediately. The first, the strike, was a result of management and employees alike in creating the same public relations as it did to show the world that we would build enough and more than enough planes to win the war. This was concluded by volunteer action and the workers who prepared company banners with material and by using workers who survived fighting against their benches or machines or who have been away on leave at the shop.

On the other hand at plant workers were faced with the "blackout" problem. It was necessary to convert every plant at once to a full blackout stage in that factory production made go forward, even in the event of an air raid. Fortunately, the Douglas Long Beach plant was built for just such an emergency and came through with orders from Lockheed, not in form, but to buy 3000 planes of black paint and have a crew of 100 men to wash for three days a 24 hr schedule in blacking out a more than one million square feet, at 27 acres of window glass. Other plants, like

and Ford, had the same emergency successfully. Production is now moving encouragingly as new plants come into production programs are completed, and old plants and workers show a new zeal.

## Bondix Hovers

Bondix Aviation, Ltd., formerly of Burbank, has moved into the new plant in North Hollywood, Calif. Representing a \$1,000,000 investment, the new plant is on a 30 acre site and consists of two modern buildings with a total of 115,000 sq. ft. of floor space, air conditioned, and basement lighted for 24-hour operation.

Extensive additions of equipment have been made to further increase the company's production of aircraft parts. A large investment has been made in equipment for a new hydraulic and electric research and development laboratory.

## California Training Job

A state-wide program designed to teach skill techniques in aircraft and shipbuilding has been started in California. The program is directed by the University of California, supported by the United States Office of Education. In California, the San Diego State College and the San Jose State College are among those 1000 job

workers in aircraft factories covered in about twenty-five states free, highly technical courses.

On the success of this course, they will depend the speed with the aircraft and shipbuilding will put on. Ordinary prerequisites include some college training and experience in defense industry. Students are admitted only after a qualifying examination determines the aptitude for the particular course. Usually training spans a week for a two or three hour session, the workers will receive assignments to keep them busy for 4 to 8 hours at home.

## Corrosion

In the December 1941 issue of AVIATION, page 156, it was stated erroneously that Pan American Airways had a fatal accident in Brazil on August 15, 1940, killing 55 persons, including the crew of four. The error is corrected. For Pan American Airways had no fatal accidents in 1940.

The Brazil accident referred to occurred on August 13, 1939. However, there were only 14 fatalities, including the crew of four.

## Services Buy Planes

War and Navy Department is buying from civilian owners approximately 300 aircraft for use in connection with military and naval activities. Purchase will be based on inspection and approval reports of the C.A.S. Aircraft selected by the Services for purchase are of specific type most suitable to the military or naval service. C.A.S. is inspecting and approving the aircraft under consideration.

Some owners of civilian planes have offered them for sale to the Government, and in some instances, offered them as gifts. War Department is appreciative that some planes were made available for the use for which they are needed. Owners of planes wanted are advised by Government agencies.

## Navy Wants Mechanic-Instructors

The Navy needs men with mechanical aviation experience to act as instructors in their schools for mechanics and machinists. The positions are under Civil Service positions ranging from \$1650 to \$3600 a year. These positions are open to anyone with the required Civil Service experience. The salaries may be changed from any Postmaster. The experience, when accepted, should be sent to the Officer-In-Charge, Navy Technician-Training Center, 970 Street and Auxiliary Avenue, Chicago, Ill.



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MAJOR FULL COLONEL, Arthur L. Smith, Chief of Public Air Force, Army Air Forces in Washington, was recently promoted from Lieutenant Colonel to Colonel for excellent work.



Recent arrivals in RAF control planes is to use Hurricane fighters as light bombers. Many daylight raids have been made over France with the fighter carrying two 250 lb. bombs. Cannon crews believe they could carry four bombs of this size. Crews here are Canadian.

# Canadian Aviation News

Trans-Canada Airlines, publicly owned transportation company, is to extend its service to Newfoundland and Alaska as soon as aircraft of the appropriate type can be obtained, according to a recent statement of W. J. Fynewick, president. Actual provision of service in these areas has not been decided on yet, however.

TCA at the beginning of 1941 operated six planes 18 hours daily and at the August end of 1941 was operating more than 15,000 miles every twenty-four hours. Approximately three out of four passengers on the route between Montreal and Vancouver were traveling on business during the year to increase and increase facilities by the Canadian Department of Transport, which was operating out of the airfield used by TCA as a wartime measure. It is hoped, however, Montreal has been given over entirely to military operations and TCA now uses the new Montreal airport at Dorval. TCA dispatches a scheduled Canadian Air Force fighter instruments, metal repair shops, military aircraft and other units serving in air force places. The entire new operator in Lockheed, the operations with British Overseas Airways have been closer due to the war.

## On Schedule

By "Wife"

Just a month ago at this writing the United States entered the second World War, the representatives of the passengers to the Pacific Oceanliner ship on the remaining international airlines has been so profound that it is worth while to look into the situation further.

It has now become apparent that The American Airways was very thoroughly prepared for any such event—a ship which was on its way to Hawaii during the attack on Pearl Harbor resumed its route by radio, and promptly resumed under wartime restrictions, leading at an emergency port instead of its usual destination. The preparation of this company was further emphasized when another ship arrived in New York after an even longer voyage from New Zealand via India and Africa to North America. It is perhaps a pity that this flight had to be made under such conditions of absolute secrecy, the course followed must have resembled the last link in Pan American's round the world route, and if this country had not been beset with its military progress, more notice would undoubtedly have been given to the general public. For it is the safe assumption of this shipper is a credit to the company, which, apart from the loss of an old Sikorsky 50 in at Hong Kong, does not appear to have lost any other equipment. For the time being the route across the Pacific has been suspended, though it is expected that the connection with New Zealand will be resumed shortly to simplify travel to Java, where the high command for the Pacific will be located. All the other routes have either been increased or expanded, thanks to the happy fact that the last traces of Axis influence in Latin America have been wiped off the map.

Only two companies were still operating under Axis auspices in South America, the Condor Lines, flying twice a week of routes, and the Lufthansa, which maintained the best connection with Europe. The Lufthansa suspended all operations some days before America entered the war, the Condor line tried desperately to continue services, but lack of fuel and oil, even though Condor offered Air France \$100 per gallon of aviation gas, ended its life. The latest news about the Condor line appears to be that it has been taken over by the Brazilian Government, and will be completely controlled and operated by Brazilian interests.

Of the other airlines of the United States, those of the Australians, British, Netherlands and Netherlands Indians are still in operation, and the connection from Australia to the New East and Egypt still seems to be possible, avoiding Mexico of course. Africa action news has been received about British Overseas Airways operations, but the Far East situation seems to have made much improvement, and services are probably operated from Singapore direct to Sumatra and thence on to Singapore. The Netherlands airlines and the Australian Airlines each suffered a casualty—the KLM lost a plane taking off at London by a Japanese plane, the KLM lost a DC-3, shot down by a Japanese plane, and Singapore, and a Queen's flying boat was in an East Indian harbor with the loss of four lives due to engine failure.

Being back to Europe—a general decrease in mail air lines but service very apparent, the service to the Pacific Oceanliner ship and perhaps the British air operation which might be called regular service, all other lines have become purely military and diplomatic connections, and it is hard to find a real road for these services. Apparently the German Luftwaffe never got over the absolute incapacity to enter into business during the German attempt of Russia—its manager has been placed at the head of an organization for transportation to the eastern front and most aircraft are in military use. About the same situation exists for the British QY, the Pan American Mailer and the Canadian Lines, while such mail services are being done on Victory orders can be discontinued completely. The only lines which have still a semblance of international service are those connecting Germany and Italy with London, but control under their hands.

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**Maj. General GEORGE BEATTY** was made Deputy Supreme Commander on the Gun Island, of the widely important, United Nations in the South West Pacific area. He is an aviation officer.



**Maj. General DONALD G. SIMPSON** has been made commander of all our army forces in the Southwest Pacific. His appointment is significant of the new importance of air activities.



**Rear Admiral CHESTER NIMITZ** has the high job of directing our Pacific Fleet. Navy officers look at him as a general, and the Navy the military organization as a high official.



**ACTING CHIEF OF THE AIR CORPS** is now Maj. General WALTER WEAVER, formerly in command of the existing Southwest Pacific Force. He has had a long Air Corps career.



**THE WEST SOUTH-EAST Command** is now under the command of Maj. General L. HENRY. He is the Air Corps, the new Southwest C. O. of Maxwell Field, has been in the city since 1940.



**Lt. Col. JAMES O'LEARY** is a member of the 11th Air Force, 400th Bombardment Group, and is a member of the 11th Air Force, 400th Bombardment Group, and is a member of the 11th Air Force, 400th Bombardment Group.



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Freedly America grows her fires... the winged eagles of wartime  
... aerial expositions of Democracy.

## Exide

IN THE AIR SINCE 1917

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The World's Largest Manufacturers of Storage Batteries for Every Purpose  
Leda Sakuma of Canada, Limited, Toronto

The war was well advertised with aircraft hoarding. Both United Aircraft Corp. and Vultee Aircraft, Inc., offered large blocks of preferred and common stock, respectively, last month for purchase by their stockholders and the public at large. Through the new financing United Aircraft raised \$25,000,000 for research activities and general corporate funds while Vultee offered \$5,000,000 worth of common stock for sale, the proceeds to go towards purchase of a controlling interest in Canadian-based Alouett. A public offer

ing also was made of a block of 21,446 shares of Grumman Aircraft Co. at \$21.50 a share. The shares were part of 21,446 shares of Grumman held jointly by Duane L. Wallace and Dwight H. Wallace, the company's two principal stockholders, and was offered by an investing brokerage firm for their account.

**Recent mergers** changes in the banking field include the transfer of all preexisting assets and liabilities of the First American Bank to a wholly owned Louisiana subsidiary, the First American Bank, Ltd., the New Orleans

**Yun M. Gindoff**, well known steel executive as chairman of Republic Steel Corp., third largest steel concern in the United States, has assumed a position of similar status in the Soviet industry by becoming chairman of the board and chief executive

Early reports of 1961 operations of aircraft manufacturing companies present an impressive expansion of the industry's accomplishments. Pratt & Whitney's 1961 production of 1,000 engines for the Boeing 707, the first year of production of the 707, is a significant achievement. The company's 1961 production of 1,000 engines for the Boeing 707, the first year of production of the 707, is a significant achievement. The company's 1961 production of 1,000 engines for the Boeing 707, the first year of production of the 707, is a significant achievement.

—By Raymond L. Heather

[illegible]

sales jump of 166 per cent, recorded net earnings of \$6.38 a share for the year ended Sept. 30, 2004, in contrast to profits of \$15 in the preceding year.

and confidence levels. The latter was 95.5% (with a 95% confidence level of 95.0%) and the former was 95.0% (with a 95% confidence level of 94.6%).

At the same time, Fisher Aircraft's estimate projects all development in the year ended Nov. 22, 1993, at \$2.5 million, or a fairly small amount. The company's net profits of 20 cents a common share for the year ended Nov. 22, 1992, were \$1.8 million. While Aerospace reports estimates of \$1.22 a common share for 1993, it also reports a loss of \$1.84, or a major increase that would indicate that the previous year's earnings were inflated. The company's share. Aerospace Common's shares, however, closed at \$7 in 1992.

**North Atlantic** reported second quarter earnings of \$11.5 a share for the third year ended Sept. 30, 1943, in a volume of supplies and parts parts which totaled \$5,423,000, of which \$1 per cent was contributed by the third quarter of the fiscal year 1943. However, in connection with its financing operation, announced last profits for the ten months ended Oct. 21, 1943, were \$4.7 a share, or \$1.75 per share, for the period ended \$295,550,000.

Commercial airlines report that 1941 traffic volume at the last office in history, although profits did not keep pace with business volume. Preliminary estimates are that American Airlines continued to lead the field in passenger revenues with United Airlines, Eastern, and

**Murray Aircoff** Carpathian pools arranging sale of its airport and air-conditioned air-

a) San Bernardino, Calif., to the War Department for use as an Air Corps maintenance base. For the present production is continuing at San Bernardino on the first group of Morrow Victory Trainers. Tools and jigs are being constructed for use in new deconstructed factory buildings where production of the trainer will be carried on. In addition to the production of aircraft parts for other mass factories.

**Haas and Haas** ... **Self** ... **Assistant's** declaration of a 25 percent dividend per share for the year of 1941 was somewhat better than had been expected at Wall Street. ... **Col. Avench** is expected to report a small net profit for the year ended Oct. 31, 1941, as compared with a net loss of \$25,000 in 1940. "Dividend dividend" checks total up more than \$1,000,000 were distributed a short time ago. 50,000 employees of **Haas and Haas**. **Ann** ... **Employment** ... **Corp.** of **Hayes, Ohio**, is now the largest single producer of polo mallets and exports to foreign countries by April, 1942.

Revenue Aircraft is pleased to enlarge operations and step up its production at such a time as Defense orders may be received. According to its president, C. E. Frazier, "Revenue Aircraft Corporation earned \$3.86 a share in the 39 week months of 1942 while Gross sales were increased 185 percent in the same period. Operating expenses were reduced making over 1,000 different aircraft parts and has stepped up its total output of these products by 1,000 percent during the last two years." Its production facilities are being increased to attain "the practically continuous operation which the government demands." The architect headed the biggest volume of activity in the aircraft industry in 1941 and 1942. Revenue Aircraft division of the fourth quarter 1941 and revenue over 700 percent greater than in the corresponding 1940 period.

United Automobile 1942 sales may total \$208,000,000 at 703 percent of 1941 shipments. Frederick R. Kestelbaum, chairman, forecast to stockholders in a recent report. . . . Chrysler division's automotive component sales, which formerly amounted to well over half the total annual business, totaled only 15 percent of volume in the 1941 fiscal year, despite a 26 percent increase in cash equipment sales. . . . *Press-Club* Auto Lines is covering more than

1999

blazes a sky-trail  
in stainless steel!



**FLEETWINGS**  
pioneers with parts  
and hydraulic  
equipment

Source: *Journal of Military Geography*, 1996, 12(2), 101-102, 101. doi:10.1080/13675889608443892

To speed production of discs, streamers made by hand and by machine. The former employs a one-disc mould, the latter by means of a disc lathe. The latter has been planned with view to a further considerable saving. A fly will drive each disc, and each worker on the disc does half a set of ten examples regardless of size of all several. Groups of eleven people have been seen doing these moulds by this streaming lathe.

Showered by Flieswings has put into operation a number of clinics around the province to help the unemployed, the money spent on living necessities, wedding expenses, etc., is provided by Flieswings' company. At the same time, Flieswings is able to build cooperatives, together, plants and industrial plants. Such is because they're not too late... with more than 100 years' experience, they now have a pile of gold and silver (wealthy) from assembly work.

Wetlands: a new, rapidly disappearing resource. For sustainable land-use planning, we need to know more about wetlands and their values. In a major contribution to the topic, *Wetlands: Hydrology and Ecosystems*, T. J. Conner and J. R. Turner (eds.) present a new synthesis of information that is largely new to the wetlands community. It is a comprehensive, timely, and useful addition to the professional literature. (31 references by 40 authors; the method of citing references and headings is highly original.)

TELEPHONE

**FLEETWINGS**

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in stainless steel!*

**M**EETINGS' new basic trainer, BT-18, now being produced in quantity for the U. S. Army Air Forces, is the world's first military airplane built principally of corrosion steel . . . and it's 100% welded! This new ship will be "streamlined" in many bigger and faster planes yet to come.

It's noted that Floewings should design and build the ET-13 for their engineers have long planned on developing spot-welding equipment to speed production of stainless steel aircraft and parts . . . so that Floewings has become the world's largest manufacturer of stainless steel planes and structural aircraft parts. In turn,

simulations stand on extremely flimsy wings reflects, in part, the shortage of other materials for aircraft.

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called upon "to react to many different weapons, in so many different theaters of war, with such an extensive deposit of equipment . . ." This was the second we got to a factual, official, statement on the number of American planes involved.

One lesson father's, learned in the war, it is becoming clearer, is the difficulty of knowing by sight all types of enemy assault, to avoid shooting friends and to avoid letting the enemy pass an unaided. Storms of deadly missiles are raining up all the time—being identified, avoided by, not official.

## Sergey Yeliseyevich Chernov

There is nothing new in a study of the lips in poets, except that they have displaced good craftsmanship. The reason partly lies in the fact that they are willing to take chances in going low. In Marvell they barely skinned the horses, although that was no trick, even the place was hard to combat. Most of the American poets were kept quiet there, only on the street.

An wolf, played an important part in the megafauna defense of Wake Island by the Marines. It is reported they had 12 German F-4F Wildcats at the start, and that most of them were out of commission or destroyed during the battle [2].

We have no detailed reserves as yet but indications are that cold on the East coast hasn't slowed oil operations down like molasses in January. It is one thing to put heaters on engines and start them on cold more comfortable fields and go to another to get going on the hostile tundra. It must be particularly difficult for the Germans who have to use crank gas and oil, both of which are rationed manhandle both at low temper-

As operations continue to pour in from the world war. This is carried out by the air arms. Blackwell officers, in both Army and Navy, have to go through the agony of changing their convictions as being contradicted. It makes the Air construction trouble, because Congressmen and editors and columnists look for a separate or common sense. Scientifically it emphasizes the importance

on land, and especially on sea, on both sides, because they fall in these objectives while keeping clear of airplanes. On the other hand all governments and military authorities have trouble keeping people from believing that airplanes alone can win wars.

On the South American front, Brazil passed the last Asoa vote to the ground, only Argentina and Chile still commiserated with the Cavewans, and that seemed to be weakening. Meanwhile, the Administration, with Garret Mince added to its sixth/axis staff, went to the Rio conference, determined to promote a Pan American air system that will spruce out one Old Warden, and more important, build trade in this hemisphere.

In Washington, the big and small fry binned for weeks about the President's call for 60,000 airplanes this year, and 125,000 next year. Everybody had his own idea, except on two points all agreed it would be easier to make the second year's assignment than the first and they all agreed that it was just a matter of time, and not much of that, as history went.

In the matter of airplane design policies, you can find out a thing or two, if you look diligently, but you can't guess it without getting into trouble. In general, the Soviets are actually dead-end, using an types of planes now. There are 15 more or less, major types destined for heavy production. Watch the news reports day by day and you will see a couple or three airplanes drop out of the rosters.

### Are Transport Problems

An transport received five assurances that the Aden station does not intend to take it over, but it has many troubles ahead, starting planes to special defense missions, landing planes to the Army, searching passengers and their luggage, detaching important military and naval staff units, trying to get into occasions for higher costs, leaving away old customers for special bigwigs who will disappear with power, rigging up some kind of anti-moonbeams system.

And last, but not least, because the Civil Air Patrol will be bigger, they say, than the Army and Navy air forces ever heard, private aviation got a job. Practically everybody with airplanes or just a license for them, can get into CAP, and make a donation.

AMERICA AT WAR  
(Continued from Page 79)

**FLEETWINGS**  
pieces with parts  
and hydraulic  
equipment

Source: *Journal of Military Geography*, 1996, 12(2), pp. 101-102.

To speed production of discs, engineers modified lathes and cutters. But phono companies have found much to learn by going flying. "We've learned a lot," says Howard, who pioneered work in the area of laser-etched recordable discs. "The soft discs work fine, and work worked on the hard discs, but you can't do anything anywhere near as good." Gratings of closely packed lines have been made there, inspired by the patterns in the sea urchin.

Shed by Flieswings has put into operation a number of ideas aimed at making members' employment of the money spent on flying outdoors wedding sessions paid for by Flieswings easier. At a small Flieswings table in hotel accommodations, couples photos and scheduled party lists because they're not too late... with more than 100 hours' experience, they now have a piece of post and will certainly have assembly costs.

Wetlands: a new, rapidly disappearing resource. For sustainable land-use planning, we need to know more about wetlands and their values. In a major contribution to the topic, *Wetlands: Hydrology and Management*, by T. J. Conner and J. R. Turner, presents a new synthesis of information that is largely new to the wetlands community. It covers hydrology, biology, and management of wetlands, and provides a synthesis of the current state of knowledge. The book is a valuable reference for the wetlands community and for those who are interested in the management of wetlands.




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22



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**VISUAL  
GAGE**  
for the  
Precision  
Checking of



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- 2 Height and Depth
- 3 Outside Diameter
- 4 Inside Diameter, Taper, Out-of-Round, Ball Mouth
- 5 Pitch Diameter of Screw Threads
- 6 Angularity of Surfaces or Between a Bore and a Surface
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**SHEFFIELD**

## Fight to Factory

(Continued from page 11)

the war, he was appointed a Federal Judge by President Roosevelt and then elevated to the Circuit Court of Appeals by President Roosevelt. It was this lifetime post that he found time to take a temporary job at a lower salary as Assistant Secretary of War in August, 1940. A few months later he was raised to be Under Secretary. Throughout the months of his service in the War Department, he has demonstrated a keen appreciation of the problems faced by industry and labor in their efforts to build the mighty war machine which America must have to survive.

In September of last year, Under Secretary Patterson established in his office a Labor Information Section under the direction of Lt. Col. A. Robert Gimbrough, a distinguished veteran of 24 years in the Army, to carry the story of the Army's needs to the factories. Working with Col. Gimbrough is Lt. Col. Donald E. Johnson, former labor editor of a New York newspaper.

The Labor Information Section went into action fast. At once it inaugurated a series of visits of information. Army personnel to key defense plants, taking Air Corps men to aviation factories, Ordnance officers to Ordnance facilities, Quartermaster officers to plants building and clothing the Army.

Quickly it found that management and labor look upon industry to personal contact with the armed forces. And what counted even more, problems definitely disappeared. One of these plant visits and outside is improved. Both management and army surveys of visited plants prove this fact.

So far as the aviation industry is concerned, the issue's inauguration opened with its trip to Cleveland. There it made a visit to three important plants: those at Jack & Shantz, the Western-Bell Company, the Packard Aircraft Company and the Cleveland Passenger Tool Co. On this trip Brig. General George Kenney, Assistant Chief of Material for the Air Corps, addressed the workers.

Up in Seattle, the army also sent its "ambassadors of good will" there. Brig. General John H. Inoué led a military delegation, composed of representatives of three Flying Fortress plants built in that factory. Here, too, Col. Gimbrough, representing the Under Secretary of War, spoke at the conclusion of the visit. The three men the guest low-keyed boarder, assembled, saw the A-20's being built, which Boeing is constructing on a sub-contract from

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Douglas. The workers were given an opportunity to walk across Boeing Field to the army hangar there and inspect at close quarters the fifty-engine, gun-mounted landers they had built.

The results of this visit, the first to an airplane manufacturing concern, were so satisfactory that the army decided to run visits to some of the aircraft companies in California.

A month later, the visit to Southern California took place. At Lockheed plant No. 2, the party went through the multi-story factory building, studying the processing of parts. Here there was no actual assembly point there, Col. Gimbrough "inspector" his talk—speaking over the plant police officers looking on every side and corner in the building. Then, the party went out to Vega Plant No. 2 where they saw the thousands of parts for bombers. At the huge Lockheed Plant 1, they passed down the assembly line of B-24s. And later that day, the fact went over to the huge new Vega Plant No. 1 where preliminary work already was being done under the "EVID" plan for many forthcoming Flying Fortresses. Here, on every B-27, the first the workers had seen close-up, was brought right to the factory doors. It was why workers were able to inspect the huge plane they were soon to work on.

On the following day, the entire visiting delegation met with the employers and company and union officials at Nuttall House, they saw the last moved Value assembly line on which army trainers are built. It was an education in mass production to them to see the construction of aircraft.

It was here that some 2,500 Value workers collected at the end of the Value flying field to hear the Army's message. It was here that Col. Gimbrough and his party conferred with the big of a combat fighter awaiting shipment to China, for the delivery of his bill.

The afternoon, the party proceeded to Long Beach where it went through the new Douglas plant. The Col. Gimbrough spoke to some 2,000 of the workers at the close of the day shift. His on the flight shift came in a 24-hour to learn, too.

The trip was followed on the following day with a briefing demonstration at the Santa Monica plant of Douglas. Here it was that about 15,000 industrial workers congregated outside the plant to listen to the army. There it was that these men and women stood as straight as standards when the Star Spangled Banner was played for them by their own band. Here it was that they kept the sky with their cheers when Colonel Gimbrough announced.

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AVIATION February 1946



Mechanical testing department at Alcoa's Components Inc.

tion, DPM; Leslie E. Newell, Editor, *Aviation* magazine, 22 E. Oak, Portland, Oregon; Walter P. Spindler, Director, WEIR, Frank R. McElroy, Regional Coordinator, DPM; Major H. K. Morris, U. S. Army Air Corps; Frank Telenor, publisher of *Aero Digest*, P. O. Box 64, U. S. Army Air Corps; R. A. Van Hise, Vice President in charge of production, Lockheed Aircraft Corp., Cal. John H. Isaac, President, Aeronautical Chapter of Engineers, Leo M. Byrne, Executive Secretary, Research Institute of America, Inc., and many others. At almost all of these meetings an informal discussion period was held in order that members could query the speakers concerning current matters of which further information was desired. It is impossible to estimate the collective value of such a series of meetings as this, but it is certainly very great.

#### INFORMATION BULLETINS DISSEMINATED

One work of spreading air-bulletins is not a new way job. We also collect information from our members periodically and such information is of vital help to the members themselves, as well as to the government. Some of the parts covered in bulletins sent to members during the past few months include: plant protection, wings, mod-

ifications, hours of employment, and working conditions, home plant installation by various firms, giving actual amount of hours generated, information on research required by the OPL, priorities information, air travel pass, general library plans, reports on congressional hearings, information on various contract awards, specification information, etc.

It will be obvious that a great many vital problems are being covered by these bulletins. In many cases, such as problems of labor, priorities, contract awards, congressional hearings, etc., the reports are more or less continuous and progressive, giving our members a cumulative report of late developments week by week and sometimes almost day to day.

Many problems of association members are defined if not completely solved. In many cases action can be taken through the association to eliminate interfering conditions which cannot be safely removed. Priorities and labor troubles are probably the most prevalent. Labor problems are of many kinds. Inadequate money wages are troublesome, but there are continuous negotiations on points of wages and working conditions. And the labor situation is still further complicated by the shortage of skilled men which results in some pinning of men, even among members



A corner of the Alcoa's Tools, Inc. machine shop.

AVIATION February 1946

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of the association. However, it is quite safe to say that the association members have been able to do a great deal more to correct the conditions than have those firms in the area who are not in the association. One plan which has helped is to have members agree to raise service letters to all persons leaving their employ. This has reduced the "stealing" of skilled men which is now prevalent throughout the crane industry. The problem of wages is much more difficult to solve because of the present rising cost of wages and profits. This is especially true because the parts manufacturers almost invariably benefit on the basis of a competitive bid contract at the fixed price. If a wage increase goes into effect after a fixed order has been taken at a fixed price it is often considered at a loss. The subcontractor has such a line like the protection of many prime contractors who are now able to obtain business on a cost plus basis, or who have master clauses in certain of their contracts permitting increased costs of labor to be passed along to the government.

#### INFORMAL NEGOTIATIONS HELPFUL

One of the major functions of an association is its ability to carry on discussions and negotiations direct with the prime contractors in behalf of one or more sub-contractors who might otherwise find themselves going to the prime contractor direct. We have been able to adjust many differences by this method and have succeeded in helping the prime contractors and sub-contractors together on many important points dealing with methods of contract placement and handling, work specifications, standardization, provision of materials, handling of priorities allocations, etc. We have been able to persuade a similar handling in working with the local office of the CMAA and have achieved substantial progress in detailed matters concerning such points as personnel, simplification of reports, arrangements for establishing committees, etc.

There are still many problems that need immediate and continuing attention, and that is why our association is more important today than at any time since it was formed. We don't expect to solve all these problems. In fact, we think that important problems will continue to arise as long as we continue to push defense problems to its new levels. And that means that at least as long as this war lasts we need the contribution to industrial efficiency which such an association can best render. And it is only partly but the problems of peace and world-wide industrial alignments it will bring will make the activities of the association even more vital in the reconstruction period following the present emergency.



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AVIATION, February, 1946



Fig. 1. Beam to measure specimen.



Fig. 2. Beam impact specimen

which is tested as a simple beam (three point loading). The span length is at least 16 times the thickness and the length of the specimen is two inches plus the span length, to permit an over hang of one inch on each end. The width of the specimen is not less than one inch. The test specimen is shown in Figure 3.

The load is applied at center of span through a bearing block of one-half inch radius. Bearing plates of sufficient size to prevent local deformation at reaction points are used.

The bend gage provides the span to be varied so that the length may be changed with the thickness of specimen. The width and thickness at the center of the span are measured to the nearest 0.001 in. The span is measured to the nearest 0.01 in.

The rate of load travel is 0.15 to 0.25 in. per minute. If load deformation data are being taken, the rate of load travel is not greater than 0.05

in. per minute, while gage readings are made. After removal of the gage, the rate of load travel is increased to the specified 0.15 to 0.25 in. per minute and the specimen loaded to fracture or past the ultimate load. Deformation is measured with an accuracy of 0.001 in.

### IMPACT TESTING

The specimen for the impact test is machined. If necessary, the specimen may be made up of laminations to produce the type shown in Figure 2.

Impact strength is determined on a pendulum type cantilever beam test machine, machine of suitable capacity similar to that used by the American Society for Testing Materials for plastic specimens.

When a composite specimen, made up of laminations, is used, the laminations are in clear contact and the notch accurately aligned.

### BEARING STRENGTH

The test specimen is a plastic plate which replaces the metal center plate in three-plate shear jig. The bearing strength is determined for shear pins (hard steel pins) of 1/8, 1/4 and 3/8 in. diameter, inserted through holes of the same size in the test specimen.

Bearing stress is determined from stress-strain data at a total deformation of 4 percent of the pin diameter. The deformation shall be accurate within 0.001 in. The rate of load travel is not greater than 0.25 in. per minute.

### SHARP BENDING

The test specimen is a round cylindrical specimen machined from a single, and of a length two times the diameter plus 1 in. The diameter is not specified and a three plate jig is used. The total bearing area of the two side plates is equal to that of the center plate. The width of the center plate is equal to the diameter of the cylinder. The jig is used with cold-chamber equipment.

The diameter is measured to the nearest 0.001 in. The rate of load travel is not greater than 0.25 in. per minute.

Comparison of 3 types of shear test specimens is shown in Exhibit B. The differences are not large.

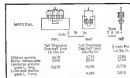


Exhibit B: Results of three types of shear tests. No one half thick plastic sheet.



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and detailed answer to this question has not been forthcoming from any governmental agency, nor is it likely that it will at the near future. However, a broad, general answer is to be found in the passing together of a series of official action and pronouncements. Civil aviation is not grounded. The Skunk has stopped on private flying by the Civil Aeronautics Administration. December 8 was a temporary expedient to permit immediate investigation of the citizenship, character and loyalty of all pilots. Provisions were placed in effect for prompt reinstatement of certificates following satisfactory investigation.

The Civil Aeronautics Board shortly thereafter promulgated stringent new regulations having in their purpose the tight control of civil aviation both for the protection of such flying and for the prevention of sabotage and espionage by civil aircraft.

The new regulations forbid anyone of attempt to permit any other person to operate from within the cockpit has actually examined the pilot certificate of the person desiring to act as second in command and has secured proper identification. All pilots are required to carry identification cards containing their fingerprints, picture and signature. In addition, before taking off from any airport, a pilot must present his pilot certificate and identification card to the pilot officer or other authorized person at the airport and receive clearance for his proposed flight. In doing so he must also file a statement identifying the place and timing of a detailed plan of his flight.

The carrying of baggage, cargo, and persons in aircraft other than those on established airlines are also restricted. Baggage and cargo can only be carried if a list first been thoroughly searched by the pilot or someone he designates and persons must be made inadmissible to the passengers.

The C.A.B. also vital Army contract training and the Civilian Pilot Training Program, may provide a satisfactory framework within which civil flying, as a business, may survive during the war period. Although flying other than that has not been prohibited, it is not unlikely that all flying that does not contribute to the defense effort will be officially frowned upon, if not prohibited. Meanwhile, aviation supervision over all forms of civil flying is certain.

There has been some discussion by CAP officials of the possibility of obtaining appropriations for the maintenance of pilot and plane centers for aerial services personnel, although no definite information is now available. There is every possibility that civil aviation, under wise administration and with intelligent cooperation from pilots

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the machine is supercharged the mill-rod maximum speed becomes less until no reaching the absolute ceiling of the stretch the indicated flying speed and stilling speed of the machine are approximately the same, i.e., the available speed range has become nil. Therefore, although the actual stilling speed at absolute is increased and the actual flying speed is reduced, said they are approximately equal at the absolute ceiling, the reduction in speed range on the indicator will be correctly shown by the movement of the flying speed pointer toward the still speed pointer.

In this way, the instrument will show the approach to the ceiling and the reduction in speed range available for maneuvering at no indicated value of G, the still speed pointer turning toward the flying speed pointer with increase in G and the flying speed pointer turning toward the still speed pointer as the ceiling is approached. The instrument will therefore give a better indication of the practical service ceiling as shown by the pointer between the two needles from the usual 100 ft./min. rate of climb altitude.

The instrument may also be used as a "G" meter, the value of G being the indicated still speed / basic still speed.

This may be of interest, for instance, in showing the point the G at which he "blacks out" if thought to be worth while a G scale could of course be marked on the dial.

The mechanism proposed to operate the still speed pointer consists of a small counter-weight on the end of an arm pivoted within the instrument body which is free to move in a vertical direction and which is restrained against downward movement by a coil and spring. This weight moves down with increase in G and actuates through gearing a slot cam which causes the still speed pointer to rise in an amount which is proportional to the square root of the movement of the weight. The still speed pointer is concentric with the A S I pointer and makes use of the same spiral scale on the dial as the A S I pointer.

The extension of the dial scale, of course, is of the same spiral type, otherwise the A S I pointer would show the still pointer at high speed end of the scale. The outer round scale may be calibrated on 100 mph scale due to the denser spacing of the scale, but this would not apply with scales marked by 200 mph, maximum air speeds be used on tracking machines.

The instrument is intended to replace the usual A S I and therefore gives information not at present given to the pilot, without the addition of a further instrument and without any additional certification complications.



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## This **BIG** H-P-M FASTRVERSE PRESS Supports Vega Ventura Bomber Production

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Why your Red Cross urgently needs

## FIFTY MILLION DOLLARS, NOW

How the fund is allocated . . .

What it does in service

Every dollar that you give now to your Red Cross marches into the front of things where humanitarian help is needed most—up to the front and battle stations where the fighting is hottest, into the Red Cross hospitals and First Aid units where prompt medical attention and supplies may save uncountable lives. And throughout our broad land to train and equip volunteers to meet any emergency that may strike.

### How the \$50,000,000 War Fund is Used

#### SERVICE TO THE ARMED FORCES • • • • • \$25,000,000

Provides for the pay, welfare and morale of the Army and Navy, including services in areas in hospitals and during convalescence. • Provides an important link between the service men and their families; keeps the families from becoming uprooted, lonely, shelterless, and even jobless where necessary. • Provides essential medical and other supplies essential to standard Government equipment. • Operates Red Cross health quarters at camps and naval stations. • Provides blood donors and medical technicians for Army and Navy needs. • Provides supplies of surgical dressings, ointments, socks, etc. for our volunteer workers.

#### DISASTER AND CIVILIAN EMERGENCY RELIEF • \$10,000,000

Supplies emergency needs for food, clothing, shelter and medical attention for disaster victims. • Assures shelter, supplies in regions of famine and other hardships; provides necessary resources of material relief supplies to prevent unnecessary delays.

#### CIVILIAN DEFENSE SERVICES • • • • • \$ 5,000,000

Trains volunteers for home saving and war-aid relief. • Trains nurses, men and women, for service duty with the Army and Navy. • Trains volunteers in First Aid and accident prevention. • Trains volunteers for work in Motor Corps, Gasoline and Lubrication. • Assists sick, wounded and children in hospitals against epidemics and secondary looting. • Operates for recreation of children and their families from war-torn areas. • Assists Red Cross Chapters in establishing effective coordination of emergency relief work with local and State defense organizations.

#### SERVICE AND ASSISTANCE THROUGH CHAPTERS • \$ 4,000,000

Gives assistance and service to the 4,140 Red Cross Chapters with their 4,111 branches responsible for local Red Cross activities, particularly wartime work among the service men and their families.

#### OTHER ACTIVITIES AND CONTINGENCIES • • • • • \$ 6,000,000

Provides for unforeseen expenses in programs and for new activities made necessary by unexpected developments.

#### TOTAL • • • • • \$50,000,000

## THE AMERICAN RED CROSS \$50,000,000 WAR FUND

Note to Red Cross Contributors: Use the material on this page to induce others contributors how their donations are being expended. The same material is in the American Red Cross Journal.



*AIRADIATOR*



Note that the new VICTOR "AIRADIATOR" nozzle could replace this old nozzle without overheating.

Why not order the new nozzle? Any VICTOR distributor will gladly show you.

## Looks like a New Type Welding Nozzle—and it is!

Let's get rid of the water bucket to keep welding torch nozzles cool enough to function properly.

The new VICTOR "AIRADIATOR" nozzle will "keep a cool head" even when submerged in the hottest heat of overhead gas welding. The large, radiating surface of multiple aluminum cooling fins prevents the "pop-pop-popping" sound which is annoying to the operator and so detrimental to sound welding. The "AIRADIATOR" nozzle was designed primarily for auto glass parts welding but wherever the operator involves the very light gauge metals, tubing, preheated castings or any weld positions which cause overheated nozzles, the "AIRADIATOR" nozzle is the answer.

You won't need water buckets to keep the "AIRADIATOR" nozzle cool.

## VICTOR EQUIPMENT COMPANY

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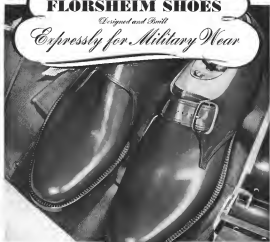
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PEARL HARBOR!



**Y**ES, like all of the other men and women of Aluminum Industries, Inc., this skilled worker remembers Pearl Harbor. His tragic memories give new meaning, new drive to his work as he expertly finishes in the new Permiste foundry, a magnesium alloy casting for a fighter plane.

This same spirit inspires the many hundreds of equally zealous workers throughout Aluminum Industries' vastly expanded, modernly equipped plants, as they turn out parts for pursuit ships, bombers, training planes. Nothing is left undone to speed production, yet zealously maintain the precision and quality of Permiste Products needed by the aviation industry and the military and naval air forces for America's Victory Program.

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and the SWORD...but Spirit will  
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NAPOLÉON

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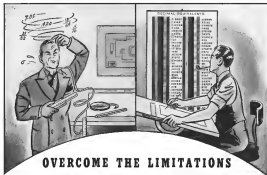
With no massive beyond precision and loyalty—no additional equipment—the same efforts of these workers raised December taking production 10% above our best previous month—a new record at Summerill.

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From the beginning of time man has striven to study and simplify his measurements.

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• The "YARD" ... originally the circumference of a man's body, later the length of the first King Henry's arm ... will later become a multiple of the foot.

• The "INCH" ... the length of 3 barley corns ... later became 1/12th of a foot.

• THE LIMITATIONS ARE THAT THESE UNITS ARE NOT MULTIPLIED OR DIVIDED BY DECIMALS.

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Direct Bore Pin (steel) Cylinder. In accuracy that a pin can be fit after 2000 ft. in.



Aircraft Valve Pin pin Bore—.0002" accuracy. In accuracy that a pin can be fit after 2000 ft. in.



A perfectly straight metal hole with a mirror finish.



Straightened Hole in the "Seven Line" in production work. Last metal finish.



Produced an extremely accurate and clean hole.

## Sheffield Corporation of Dayton, Ohio Master Gagemakers—

—uses the Sunnen RA Precision Hone to remove .015" from the hardened surface of a .375" diameter hole 3 1/2" long in a Dodge Spindle Machine. It also used on cylindrical rings. Time saved over previous method—30%.



## Save your problems of accurately finishing internal cylindrical surfaces with the SUNNEN Precision HONING MACHINE

• Sheffield says Sunnen can save 30%. Other manufacturers handling important work orders report similar production increases. By using the Sunnen Precision Honing Machine to accurately grind and finish internal cylindrical holes from .187" to 2.400", more manufacturers have been able to release heavy internal girders for other work. These manufacturers have been amazed to find that such an expensive piece of equipment can produce such accurate work. Accuracy is guaranteed to within .0002", and has often been held to within .000025" in production work. Skilled or experienced operators are not required. Any intelligent work man can produce precision workmanship with only a few hours' practice. You can shift your highly skilled labor to other jobs.

Setup setup here—the Sunnen Precision Honing Machine can be set up and work loaded ready for honing in less than one minute.

## Write for FREE 8-page Bulletin

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### *New Idea in Marine Radio Design Speeds Installation . . . Saves Space*

Off the ways . . . and on the way, going America's Liberty Ships sail fast side of new cargo vessels stretching off endlessly down the ocean roadway toward America's aid and around the world. And this vast Armada of Liberty's Arsenal is a credit to the shipbuilders' craft.

Every cubic foot has been made so account for itself against the great demand for precious cargo space. For example, in the radio room, not right or sea, but our

compact marine radio telegraph unit supplies all needed communications facilities.

This all-in-one radio unit makes it possible to do at the factory precisely all wiring and cabling work usually done aboard ship—housed in one left the same normally required—practically ready to screw in and plug in—it was designed and manufactured for the first 512 Liberty Ships by I. T. & T.'s subsidiary, The Federal Telegraph Company.



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Where the highest degree of air cleanliness is required this automatic filter stands out as the most efficient self-cleaning air filter on the market today. It removes not only the atmospheric dust and dirt collected in other types of filters but also smoke, oil dust particles, oil vapors, and welding fumes. Write for Bulletin No. 2500.



**BACTERIOSTATIC FILTER**

This filter is in general use for commercial and industrial air cleaning where dust concentrations are not allowed. It is readily adaptable to forced open, where in many cases its necessary may be converted to any desired pattern. Also used and listed by the Underwriters Laboratories. Ask for Bulletin No. 2500.



**TYPE PL UNIT FILTER**

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**TYPE W ROTO-CLONE**

The Type W Roto-Clone embodies the same principle of dynamic precipitation as the Type D Roto-Clone with the addition of water sprays which water particles the entrance of the cyclone and force down particles by wetting. Especially suitable for heavy dust concentrations and dust conditions involving a wide range of particle sizes. Ask for Bulletin No. 2744.

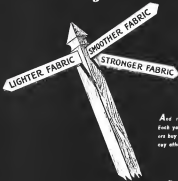
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AVIATION February 1946

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1. Valve Cap body is solid.
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3. The unique design allows of making and repairing without the need of oil. The cap is made of a single piece of metal and is not welded.
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plug cost to half  
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□<sup>4</sup>

10 20 30 40 50 60 70 80 90 100





Super propeller and variable timing parts of new Hercules engine parts made of Ampco Metal. Detail shown by Ampco in connection with aircraft.

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